Meteorology Solutions

- Solar Radiation
- Barometric Pressure
- Precipitation
- Present Weather

- Windspeed
- RH & Temperature
- Ultrasonic & Mechanical Anemometers
- Integrated Weather Stations

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GILL INSTRUMENTS

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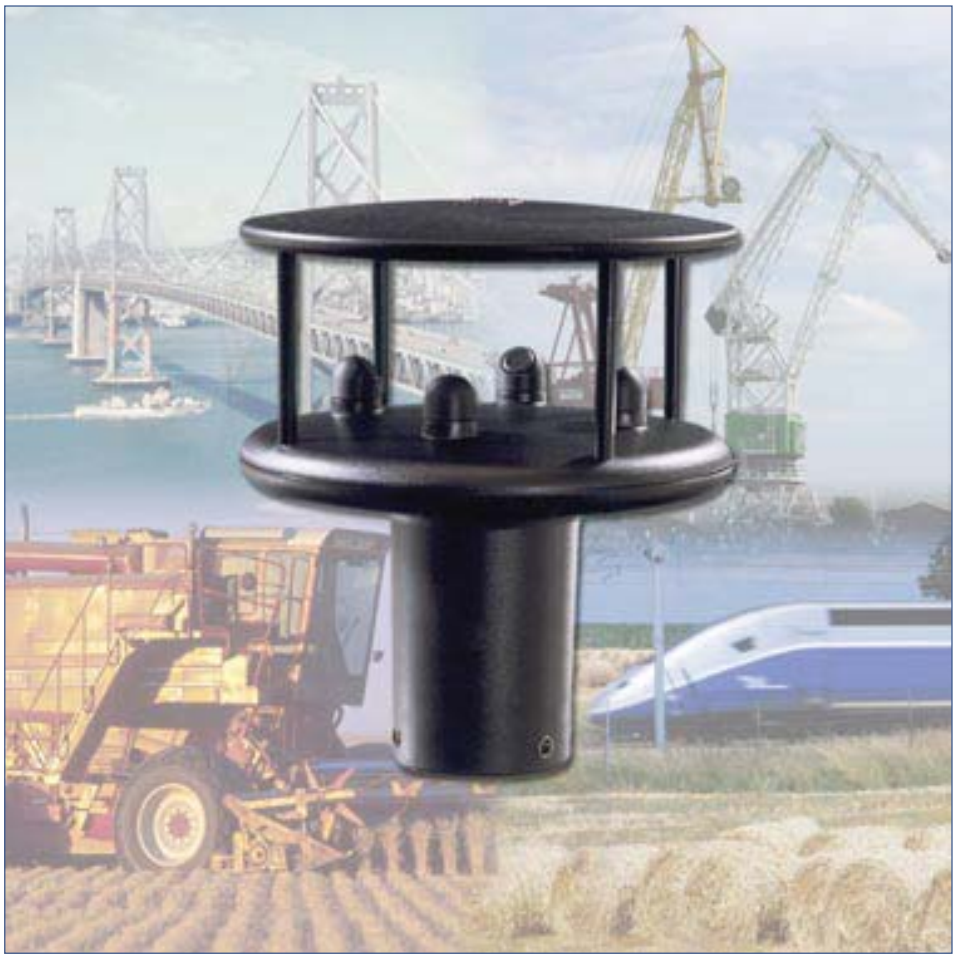
WindSonic

Wind Speed & Direction Sensor

WINDSONIC



ALL WEATHER SENSING TECHNOLOGY

MAINTENANCE FREE - 2 YEAR WARRANTY

- *LOW START SPEED*
- *CORROSION FREE, UV STABLE MATERIAL*
- *NO CALIBRATION REQUIRED*
- *ROBUST CONSTRUCTION*
- *TRUE 0-359° OPERATION (no dead band)*
- *WIND SPEED & DIRECTION FROM A SINGLE UNIT*

- *AGRICULTURE*
- *HVAC*
- *POLLUTION CONTROL*
- *PORTABLE WEATHER STATIONS*
- *ROADSIDE WEATHER STATIONS*
- *TUNNELS*
- *MARINE*

WINDSONIC - ULTRASONIC WIND SENSOR

At last, a real low cost alternative to conventional cup/vane/propeller wind sensors in a single unit - WindSonic from Gill Instruments. Utilising our expertise as the world's leading sonic manufacturer, WindSonic is based on our existing, highly successful, proven ultrasonic technology. Ideal for applications that demand economic wind sensing, WindSonic is suitable for land-based and marine environments.

A lightweight unit, WindSonic is of a robust, high strength construction designed to withstand installation and use with no fear of the damage commonly experienced with more fragile cups, vanes or propellers. Without the need for expensive on-site calibration or maintenance and with a corrosion free exterior, WindSonic is a true fit and forget unit.

The flexible design enables you to easily configure WindSonic to deliver the information you require. By using the software provided it is possible to select the output rate and choose the units of measurement that suit your application. Ensuring accuracy and reliability, WindSonic automatically transmits an anemometer status code with each output to indicate its operating status. Available in four options, providing a number of different digital and analogue outputs.

Maintenance free, quick and easy to install, WindSonic is designed to be mounted using a standard pole fitting and comes complete with all screw fittings, a mating marine grade connector and comprehensive user manual.

The unit is supplied with a 2 year warranty as standard.

CUSTOMER SELECTABLE	
Output	1, 2 or 4 outputs per second
Parameters	Wind Speed & Direction or U and V (vectors)
Units of Measure	m/s, knots, mph, kph, ft/min
WIND SPEED	
Range	0 – 60 m/s (116 knots)
Accuracy	+/- 2%
Resolution	0.01 m/s (0.02 knots)
WIND DIRECTION	
Range	0 to 359° – no dead band
Accuracy	+/- 3°
Resolution	1°
ANEMOMETER STATUS	
Message supplied as part of standard output	
POWER REQUIREMENT	
Anemometer	9-30Vdc @ 14.5mA typical Start up time <1 second
OUTPUTS	
Option 1	RS232
Option 2	RS232 + RS422 + RS485 + NMEA*
Option 3	RS232 + RS422 + RS485 + NMEA* + 0-5V or 4-20mA
Option 4	SDI-12

* NMEA 0183 Version 3

ENVIRONMENTAL	
Ingress Protection	IP65
Operating Temperature	-35°C to +70°C
Storage Temperature	-40°C to +90°C
Operating Humidity	<5% to 100%
EMC	EN 61000-6-2 : 2001 EN 61000-6-3 : 2001
MTBF	
	15 years
MATERIALS	
External Construction	LURAN S KR 2861/1C ASA/PC
DIMENSIONS	
Size	142 x 160 mm
Weight	0.45 kg
WARRANTY	
	2 years
OPTIONAL FACTORY CALIBRATION	
	Traceable to national standards
ACCESSORIES	
Pipe Mounting	44.45 mm (1.75 in) diameter
WindCom - Display & logging software *	
Cables	
Display	

* download WindCom free from www.gill.co.uk

GILL INSTRUMENTS LTD
Saltmarsh Park, 67 Gosport Street,
Lymington, Hampshire, SO41 9EG, UK
Tel: +44 (0) 1590 613500
Fax: +44 (0) 1590 613555
E-mail: anem@gill.co.uk
Website: www.gill.co.uk

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The WindSonic is part of the Solent range of ultrasonic anemometers. The range is in continuous development and therefore specifications may be subject to change without prior notice.

WindSonic™M

Ultrasonic Wind Sensor

Robust Aluminium Construction
Optional Heating System

Key Features

- Compact Wind Speed & Direction Sensor
- Hard Anodised Aluminium Alloy Construction
- -40°C Operation (with optional heating)
- NMEA output
- Impact Resistance to UL2218 Class 1
- Maintenance Free

The Gill WindSonic M utilises Gill's proven ultrasonic technology that has a proven performance over many years of operation in the popular WindSonic.

With an impact resistant, corrosion-free aluminium alloy housing and optional heating system this wind sensor is recommended for use in harsh environmental conditions and is particularly suited to both marine and land based installations. The WindSonic M has no moving parts, offering maintenance-free operation in a wide range of applications.

Wind Speed

Range	0 - 60 m/s (116 knots)
Accuracy	±2% @12 m/s
Resolution	0.01 m/s (0.02 knots)
Response Time	0.25 seconds
Threshold	0.01 m/s

Direction

Range	0 - 359° (No dead band)
Accuracy	±3° @12 m/s
Resolution	1°
Response Time	0.25 seconds

Measurement

Ultrasonic Output Rate	0.25, 0.5, 1, 2 or 4 Hz
Parameters	Wind Speed & Direction or U and V (vectors)
Units of Measure	m/s, knots, mph, kph, ft/min

Output

Outputs	RS232 + RS422 + RS485 + NMEA*
Baud Rate	2400 to 38400

Power Requirement

Anemometer	5-30V DC (5.5mA @ 12V)
Optional heating**	24V AC/DC (4.2A @ 24V)
	Start up time < 5 seconds

Mechanical

External Construction	Al. Alloy 6082 T6
Finish	Hard Anodised
Size	142mm x 160mm
Weight	0.9kg

Environmental

Protection Class	IP66
OperatingTemperature	-40°C to +70°C (with heating) -35°C to +70°C (without heating)
Storage Temperature	-40°C to +80°C
Operating Humidity	< 5% to 100% RH
EMC	EN 61326: 1998 & BSEN 60945
Impact Resistance	UL2218 Class 1

Operational

Warranty	2 years
Factory Calibration	Traceable to National Standards

Accessories

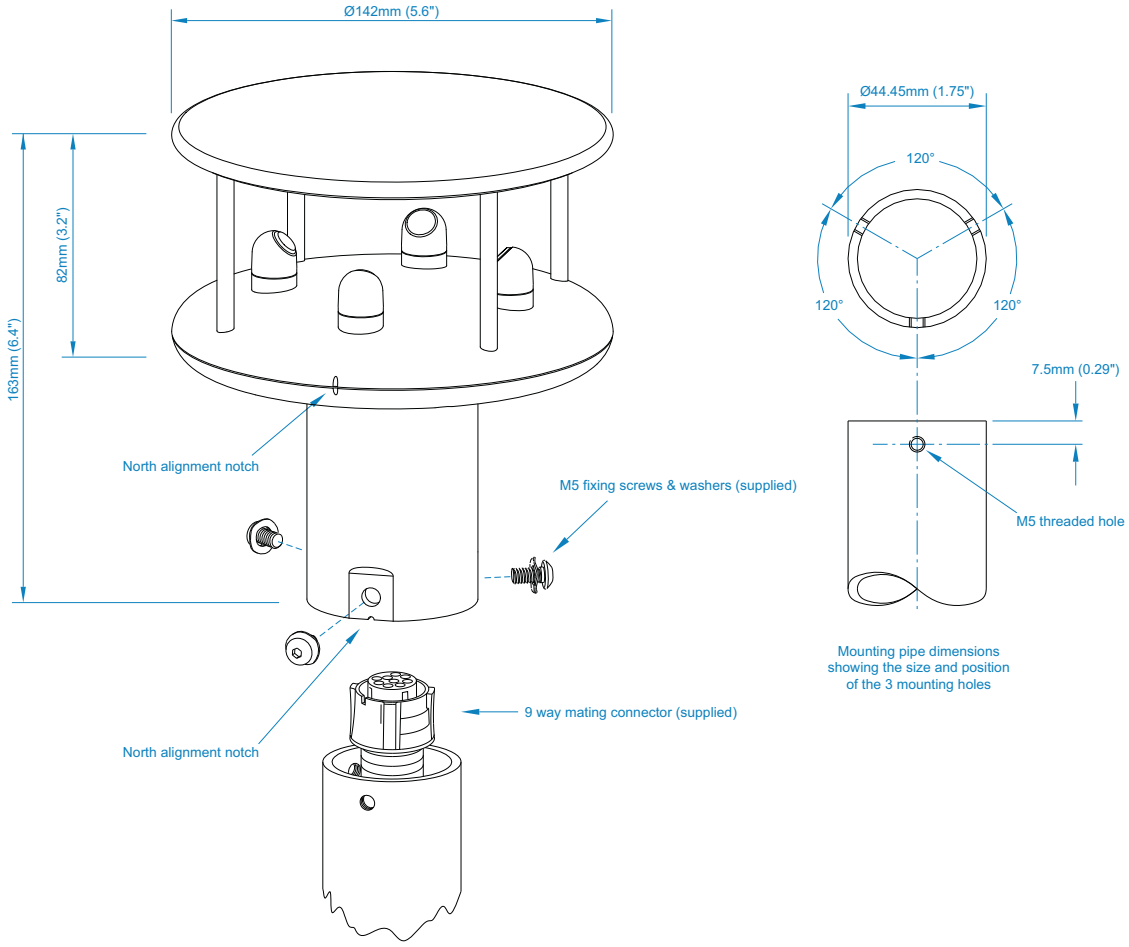
Pipe Mounting	44.45mm (1.75 in) diameter
Windview Software	Display/logging***
Cables	Available to match output options
Display	See Gill display datasheet

* NMEA 0183
** Consult the technical manual for optimum heating supply voltage.
*** Download software free from www.gill.co.uk

WindSonic™M
Ultrasonic Wind Sensor

Typical Applications

- Remote weather monitoring stations
- Building controls
- Data buoys
- Marine vessels
- Road & rail tunnels
- Environmental field sites
- Ports & harbours
- Mobile weather monitoring vehicles
- Remote airports & helipads
- Coastal weather monitoring stations



Specifications may be subject to change without prior notice.

Gill Instruments Ltd
Saltmarsh Park
67 Gosport Street
Lymington
Hampshire
SO41 9EG, UK

T: +44 (0) 1590 613 500
F: +44 (0) 1590 613 555
E: anem@gill.co.uk

www.gill.co.uk

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GILL INSTRUMENTS

WindObserver II

Wind Speed & Direction Sensor

WINDOBSERVER II

ALL WEATHER SENSING TECHNOLOGY

- *ULTRASONIC TECHNOLOGY*
- *MAINTENANCE FREE*
- *ROBUST CONSTRUCTION*
- *LLOYD'S TYPE APPROVAL*
- *LOW TEMPERATURE DE-ICING*
- *USERSELECTABLEOUTPUTFORMAT*
- *TRANSPORT SAFETY*
- *WIND TURBINE CONTROL*
- *SHIPDYNAMICPOSITIONINGSYSTEMS*
- *AIRCRAFT LANDING SYSTEMS*
- *METEOROLOGICAL SYSTEMS*
- *STRUCTURAL SAFETY*

WINDOBSERVER II - ULTRASONIC WIND SENSOR

The WindObserver II provides the best solution on the market for reliable, accurate and cost-effective wind speed and directional measurement. It combines the latest patented advances in ultrasonic technology together with Gill's fifteen years experience as the recognised world leading supplier of all-weather ultrasonic wind sensors. The elimination of moving parts, together with a rugged stainless steel construction means that WindObserver II is virtually maintenance free and requires no calibration on site. The heated head keeps the unit free from ice and snow, providing continuous use even in the most extreme weather conditions.

A new flexible design ensures that the WindObserver II can be configured by the user to their exact requirements, which may include analogue outputs, 10 Hz output, heating or sonic temperature.

The Windows™ based WindCom communications package allows the user to operate the anemometer in various modes, permitting the measurement of U & V vectors or wind speed and direction. Communication is via an RS422 bidirectional link, which allows several units to be networked together and data to be logged on demand. The WindObserver II has been rigorously tested to internationally recognised standards and meets the stringent performance criteria specified by airport, marine, oil, production, meteorological and utility organisations around the world.

DIMENSIONS	
Size	405mm x 210mm
Weight	1.5kg
MEASUREMENT	
Output	1Hz, 4Hz, 10Hz
Parameters	UV, Polar, NMEA, Tunnel
Units	m/s, Knots, MPH, KPH ft/min
Averaging	Flexible 1-3600 seconds
WIND SPEED	
Range	0 - 65 m/s (0 - 145mph)
Starting Threshold	0.01 m/s
Accuracy	2%
Resolution	0.01 m/s
Offset	± 0.01 m/s
DIRECTION	
Range	0 - 359°
Dead Band Direction	None
Accuracy	± 2°
Resolution	1°
SONIC TEMPERATURE	
Range	-40°C to + 70°C (refer to user manual)
DIGITAL OUTPUT	
Communication	RS422, full duplex
Baud Rates	1200 2400 4800 9600 19200 38400
Formats	8 data, odd, even or no parity
Anemometer Status	Supplied as part of standard message

ANALOGUE OUTPUT - OPTIONAL	
Quantity	3 (speed, direction, status or sonic temp)
Scale	Multiples of ±10 m/s up to 70 m/s
Type	± 2.5V, 0 - 5V or 4 - 20mA
V output resistance	60 Ohms
4 - 20mA loading	10 - 300 Ohms
MATERIALS	
External Construction	Stainless Steel 316
ENVIRONMENTAL	
Moisture Protection	IP66 (NEMA4X)
Operating Temperature	-55°C to +70°C
Humidity	5% to 100% RH
Precipitation	300mm/hr
EMC	EN 61000-6-2 : 2001
	EN 61000-6-3 : 2001
Icing	MILSTD810E Method 521.1 Procedure 1
MISC	
Standards	Traceable to NAMAS standards
Site Calibration	None Required
	Integrity Check Unit (Zero Wind)
	supplied as optional extra
POWER REQUIREMENT	
Anemometer only	9-30 V DC (40mA @ 12 V DC)
Heating Optional	3A @24V AC or DC

GILL INSTRUMENTS LTD
Saltmarsh Park, 67 Gosport Street,
Lymington, Hampshire, SO41 9EG, UK
Tel: +44 (0) 1590 613500
Fax: +44 (0) 1590 613555
E-mail: anem@gill.co.uk
Website: www.gill.co.uk

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The WindObserver II is part of the Solent range of ultrasonic anemometers. The range is in continuous development and therefore specifications may be subject to change without prior notice.

WindObserver™70

Ultrasonic Anemometer

Key Features

- FAA & CAA accepted* for airport applications
- Heating power 7A @24VAC or DC (1W/cm²)
- 0-70m/s wind speed range
- 0-359° wind direction range (no dead band)
- Calibration traceable to NAMAS standards
- IP66 rated stainless steel housing
- Connector or cable exit options
- Optional customer base mounts

The WindObserver 70 is a solid state, heated ultrasonic anemometer designed for use within the aviation industry and for more extreme weather conditions. The sensor has been accepted for service by both the FAA Federal Aviation Administration (USA) and the CAA Civil Aviation Authority (UK) for the observation and reporting of surface wind. This WindObserver meets the requirements of Annex 3 to the Convention on International Civil Aviation Organization (ICAO) when supplied as part of a suitable AWOS*.

With 150 Watts of electrical heating in the anemometer head producing 1 Watt/cm² and tested in accordance with MILSTD810F, the unit is particularly suited to operate as part of Aviation Automatic Weather Observing Systems, which are often exposed to extreme weather conditions. Manufactured from stainless steel with no moving parts the sensor requires no on-site calibration and minimal maintenance.

*Accepted by the FAA & CAA for the observation and reporting of surface wind as part of a suitable AWOS (Automatic Weather Observing System)

Wind Speed

Range	0 - 70 m/s (0-156mph)
Starting threshold	0.01 m/s
Accuracy	±2% @12 m/s
Resolution	0.01 m/s
Offset	±0.01 m/s

Direction

Range	0 - 359°
Dead band direction	None
Accuracy	±2° @12 m/s
Resolution	1°

Measurement

Ultrasonic output rate	1 - 4Hz
Parameters	UV, Polar, NMEA
Units	m/s, knots, mph, kph, ft/min
Averaging	Flexible 1-3600 seconds

Power Requirement

Anemometer only	9 - 30 VDC (60mA max, 50mA average)
Heating	Max 7A @24 VAC or DC

Digital Output

Communication (Operat'n)	RS422/RS485 full duplex/half duplex
Baud Rates	1200, 2400, 4800, 9600, 19200, 38400
Formats	8 bit data; odd, even or no parity
Anemometer status	Supplied as part of standard message

Mechanical

External construction	Stainless steel 316
Size	Refer to diagram overleaf
Weight	1.7kg (with 2m cable) 1.3kg (with connector)

Environmental

Protection class	IP66 (NEMA4X)
Operating temperature	-55°C to +70°C (with base connector)
Precipitation	300mm/hr
EMC	EN 61326-1: 2006, EN 55011: 2007
Icing	MILSTD810F Method 521.2 Procedure I

Approvals

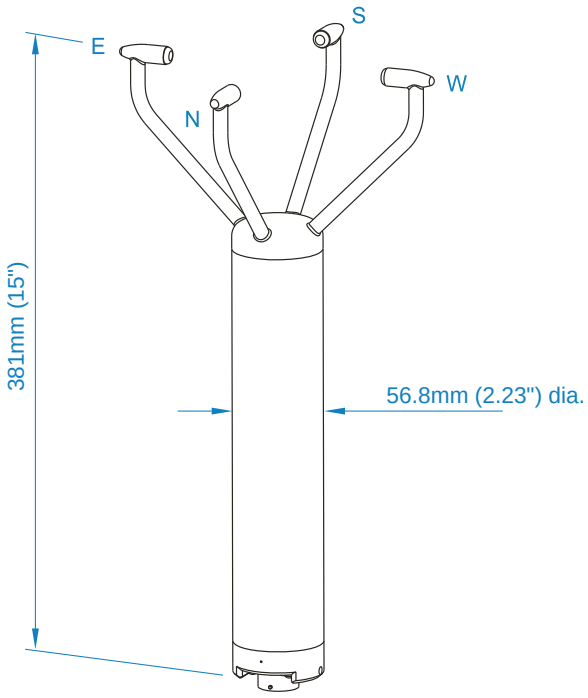
Standards	Traceable to NAMAS standards
Site Calibration	None required. Integrity check unit (Zero wind) supplied as optional extra

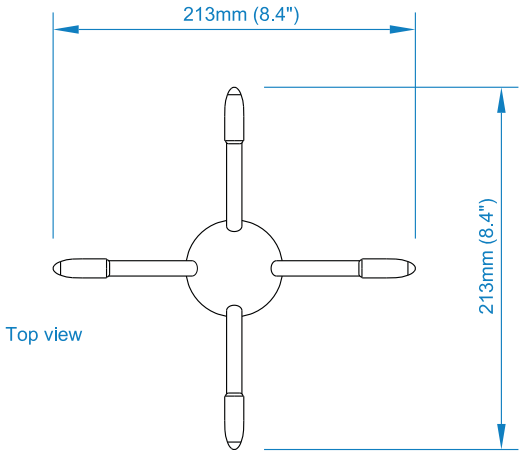
WindObserver™70

Ultrasonic Anemometer

Typical Applications

- Aviation Weather Observing Systems
- Aircraft Landing Systems
- Remote Meteorological Systems
- Helicopter Landing Pads
- Transport Safety





Note: Optional base mounts and cable exit options are available.

Specifications may be subject to change without prior notice.

Gill Instruments Ltd
Saltmarsh Park
67 Gosport Street
Lymington
Hampshire
SO41 9EG, UK

T: +44 (0) 1590 613 500
F: +44 (0) 1590 613 555
E: anem@gill.co.uk

www.gill.co.uk

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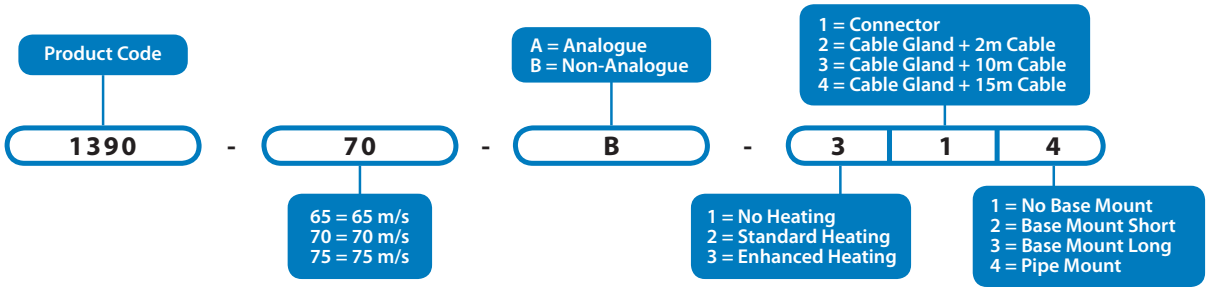
WindObserver™ OPTIONS

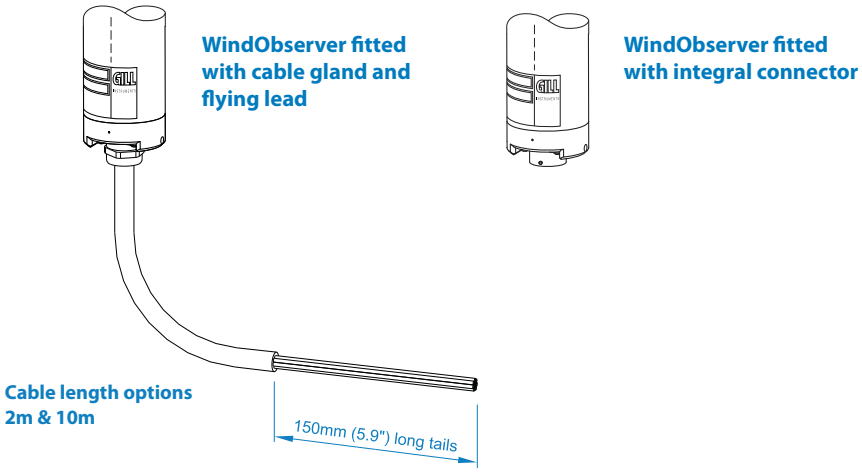
WindObserver Product Numbers Explained



Product options may be model specific. Consult the Gill sales team for availability

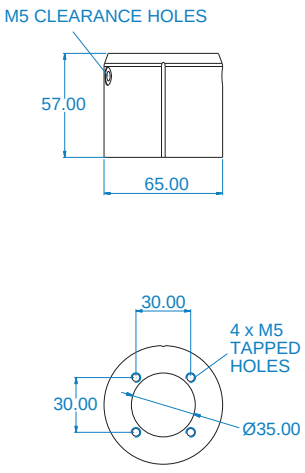
Connection Options

Drawings below shown without base mounts

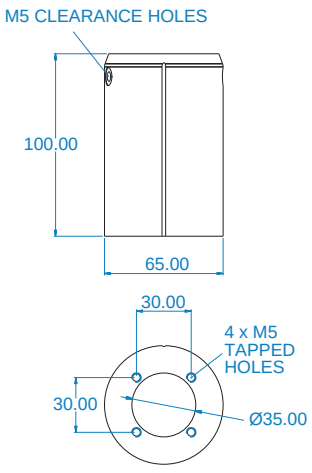

WindObserver fitted with cable gland and flying lead
WindObserver fitted with integral connector
Cable length options 2m & 10m
150mm (5.9") long tails

Base & Pipe Mount Options

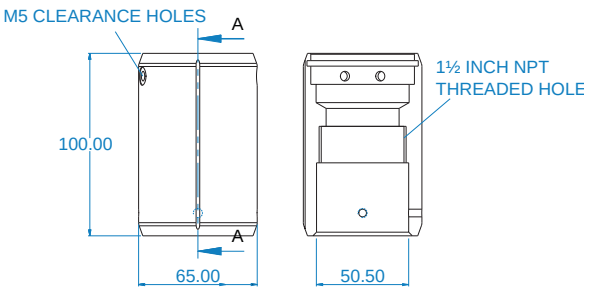
Base Mount Short



Base Mount Long



Pipe Mount



All options are supplied with appropriate fixing screws and washers.

Gill Instruments Ltd
Saltmarsh Park, 67 Gosport Street, Lymington, Hampshire, UK SO41 9EG
T: +44 (0) 1590 613 500 F: +44 (0) 1590 613 555 E: anem@gill.co.uk

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WindObserver™75

Ultrasonic Anemometer

Key Features

- Heating power 7A @ 24VAC or DC (1W/cm²)
- 0-75m/s wind speed range
- 0-359° wind direction range (no dead band)
- Wind speed accuracy for turbine control ±1% within ±25° of datum
- Calibration traceable to NAMAS standards
- IP66 rated stainless steel housing
- Connector or cable exit options
- Optional customer base mounts

The WindObserver 75 has been developed for measuring higher wind speeds in extreme weather environments featuring 150 Watts of electrical heating power in the anemometer head. This anemometer has been designed to remain ice free in most freezing weather conditions. The sensor provides data via RS422/RS485 bidirectional link, which allows several units to be networked together and data logged on demand.

With innovative transducer design, this anemometer boasts a very high wind speed range of 0 - 75 m/s (0-168mph) and gives an output status indicating the validity of data, so that you can be confident that the instrument is providing accurate information. Constructed from Stainless steel this anemometer meets the stringent performance criteria specified by wind turbine manufacturers, airports, marine, oil and gas production, and meteorological organisations around the world.

Wind Speed

Range	0 - 75 m/s (0-168mph)
Starting threshold	0.01 m/s
Accuracy	±2% @12 m/s (1% for turbine control)
Resolution	0.01 m/s
Offset	±0.01 m/s

Direction

Range	0 - 359°
Dead band direction	None
Accuracy	±2° @12 m/s (1° for turbine control)
Resolution	1°

Measurement

Ultrasonic output rate	1 - 4 Hz
Parameters	UV, Polar, NMEA
Units	m/s, knots, mph, kph, ft/min
Averaging	Flexible 1-3600 seconds

Power Requirement

Anemometer only	9 - 30 VDC (60mA max, 50mA average)
Heating	Max 7A @24 VAC or DC

Digital Output

Communication (Operat'n)	RS422/RS485 full duplex/half duplex
Baud rates	1200, 2400, 4800, 9600, 19200, 38400
Formats	8 bit data; odd, even or no parity
Anemometer status	Supplied as part of standard message

Mechanical

External construction	Stainless steel 316
Size	Refer to diagram overleaf
Weight	1.7kg (with 2m cable) 1.3kg (with connector)

Environmental

Protection class	IP66 (NEMA4X)
Humidity	< 0% to 100% RH
Operating temperature	-55°C to +70°C (with base connector)
Precipitation	300mm/hr
EMC	EN 61326-1: 2006, EN 55011: 2007
Icing	MILSTD810F Method 521.2 Procedure I

Approvals

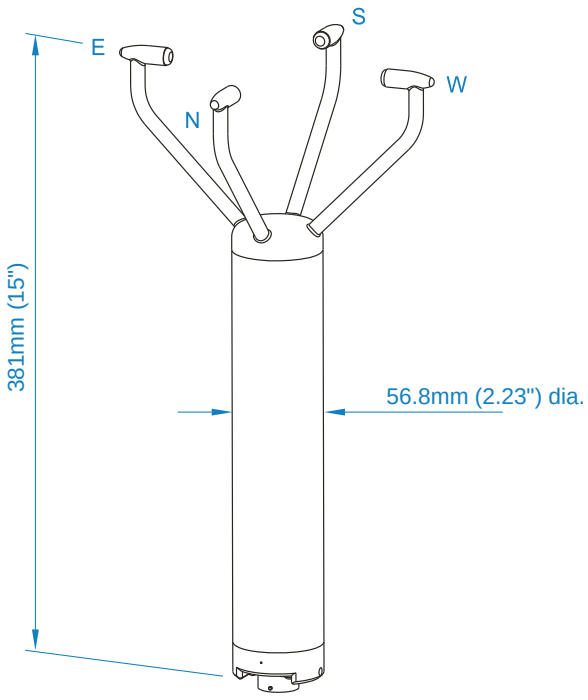
Standards	Traceable to NAMAS standards
Site calibration	None required. Integrity check unit (Zero wind) supplied as optional extra

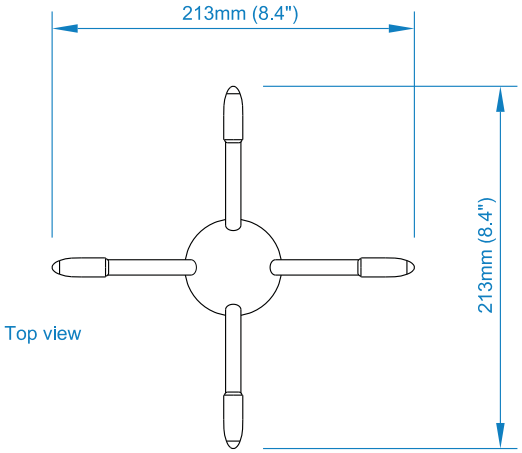
WindObserver™75

Ultrasonic Anemometer

Typical Applications

- Building controls/structural safety
- High altitude mountainous regions
- Arctic/Antarctic Weather monitoring
- Marine vessels dynamic positioning systems
- Wind turbine control
- Road & rail tunnels/transport safety
- Ports & Harbours
- Aircraft landing systems





Note: Optional base mounts and cable exit options are available.

Specifications may be subject to change without prior notice.

Gill Instruments Ltd
Saltmarsh Park
67 Gosport Street
Lymington
Hampshire
SO41 9EG, UK

T: +44 (0) 1590 613 500
F: +44 (0) 1590 613 555
E: anem@gill.co.uk

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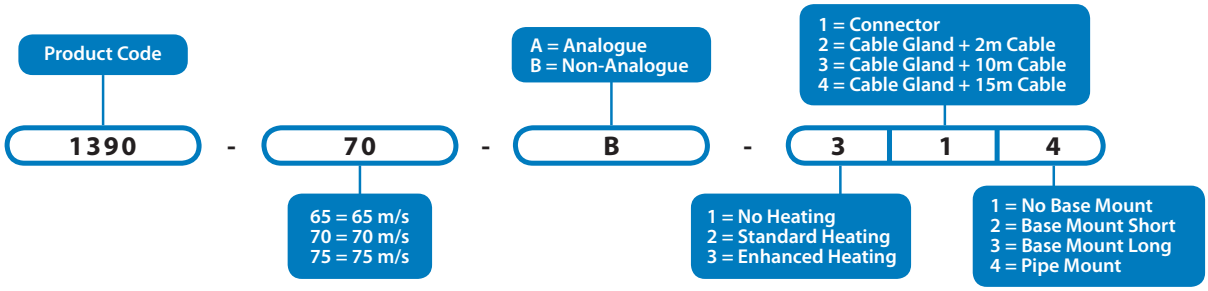
WindObserver™ OPTIONS

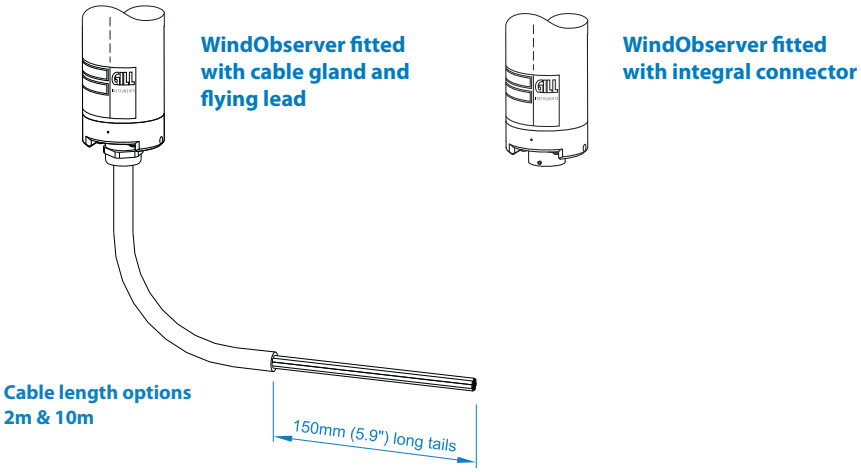
WindObserver Product Numbers Explained



Product options may be model specific. Consult the Gill sales team for availability

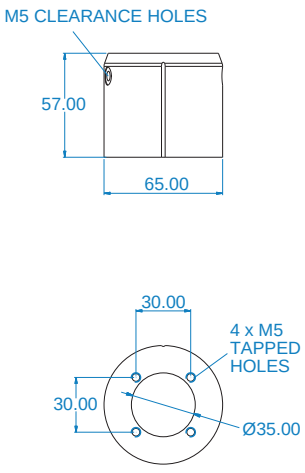
Connection Options

Drawings below shown without base mounts

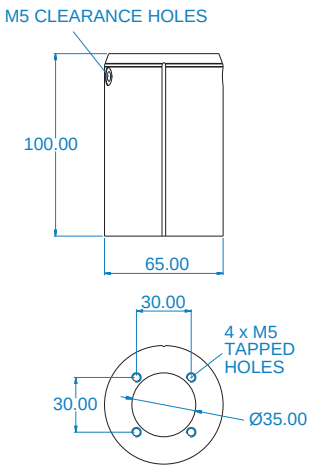

WindObserver fitted with cable gland and flying lead
WindObserver fitted with integral connector
Cable length options 2m & 10m
150mm (5.9") long tails

Base & Pipe Mount Options

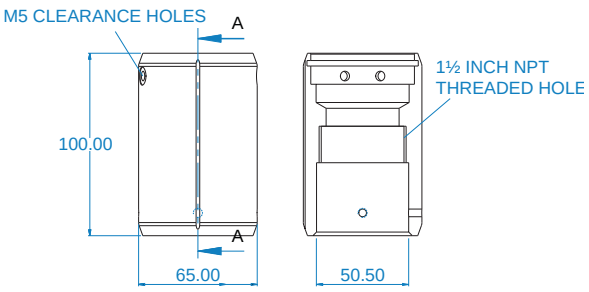
Base Mount Short



Base Mount Long



Pipe Mount



All options are supplied with appropriate fixing screws and washers.

Gill Instruments Ltd
Saltmarsh Park, 67 Gosport Street, Lymington, Hampshire, UK SO41 9EG
T: +44 (0) 1590 613 500 F: +44 (0) 1590 613 555 E: anem@gill.co.uk

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GILL INSTRUMENTS

WindMaster

3 Axis Ultrasonic Anemometer

WINDMASTER

ALL WEATHER SENSING TECHNOLOGY

- *METEOROLOGICAL SYSTEMS*
- *TRANSPORT SAFETY*
- *STRUCTURAL SAFETY*
- *WIND PROFILING*
- *MARINE RESEARCH*
- *WIND TURBINE SITE SURVEY*
- *MAINTENANCE FREE*
- *LIGHTWEIGHT CONSTRUCTION*
- *U, V, W, SOS & SONIC TEMP OUTPUT*
- *20Hz OR OPTIONAL 32Hz DATA RATE*
- *OPTIONAL ANALOGUE INPUTS OR OUTPUTS*

WINDMASTER - ULTRASONIC WIND SENSORS

The new WindMaster three axis anemometer is a robust instrument based on time of flight measurements and is essential in the understanding of turbulent flows, surface energy balance and scalar fluxes.

All these areas of research rely on accurate and precise measurements of mean and variance of (time averaged) wind velocities and Speed of Sound (SOS) derived temperature. This is particularly true in determining scalar fluxes using the eddy covariance technique. Gill employs the optimum mechanical configuration and electronic processing to minimise flow distortion and transducer shadow effects. Gill undertakes an individual calibration with a Gill wind tunnel test on each unit to provide the optimum performance. The WindMaster is available with a 20Hz data output rate with an option to increase this to 32Hz. The instrument is constructed in the familiar Aluminium/carbon fibre construction. The WindMaster is fitted with field proven standard Gill transducers with the ability to measure a top wind speed of 45 m/s.

Both software and electronics have been enhanced to provide improved vertical (W) resolution and SOS accuracy.

New design electronics has facilitated a reduction in power consumption to 30 mA at 12 V dc, a significant advantage when used on power sensitive sites.

A number of orderable options are available including: -

- Increase in data output rate to 32 Hz
- 4 analogue output channels with options for 12 or 14 bit resolution.
- 4 analogue input channels, with options for 12 or 14 bit resolution, additional PRT input also available.
- A flange mounting arrangement is provided as standard, with option to order a different mounting.
- Wind tunnel calibration in accordance with ISO 16622 and traceable to national standards.
- Travelling case

OUTPUTS	
Internal sample rate	20 Hz or 32 Hz
Output rate	1, 2, 4, 8, 10, 16, 20 & 32(option)
Units of measure	m/s, mph, KPH, knots, ft/min
Format	UVW, Polar or NMEA
Averaging	Flexible 0 - 3600 s
WIND SPEED	
Range	0 - 45 m/s
Resolution	0.01 m/s
Accuracy (12 m/s) Generic	1.5% RMS *
Accuracy (12 m/s) Custom	1% RMS *
DIRECTION	
Range	0-359°
Resolution	0.1°
Accuracy (12 m/s) Generic	2°
Accuracy (12 m/s) Custom	0.5°
SPEED OF SOUND	
Range	300 - 370 m/s
Resolution	0.01 m/s
Accuracy	< ± 0.5% @ 20°C
POWER REQUIREMENT	
	9 - 30 Vdc, 30 mA @ 12 Vdc
DIGITAL OUTPUT	
	RS232, 422, 485 network upto 26 anemometers
Baud rates	2400-115200
Format	ASCII / Binary

SONIC TEMPERATURE	
Range	-40°C TO +70 °C
Resolution	0.01°C
ANALOGUE OUTPUTS (OPTIONAL)	
Resolution 12 bits or 14 bits	4 channels available
Selectable Range	User selectable full scale wind speed
Output Type	0-20mA, 4-20mA, 0-5V, ±2.5V, ±5V
ANALOGUE INPUTS (OPTIONAL)	
Resolution 12 bits or 14 bit	Up to 4 single ended or 2 diffferential
Input Type	±5V
GENERAL	
Weight	1.0 kg
Size	750mm x 240mm
Environmental	IP65
Operating Temp	-40°C to + 70°C
Humidity	<5% to 100%
Precipitation	Operation to 300mm/hour
EMC	Emissions BS EN 61000 - 6- 3
	Immunity BS EN 61000 - 6 -2

* Accuracy spec applies for wind speed, and for wind incidence up to ± 30° from the horizontal

GILL INSTRUMENTS LTD
Saltmarsh Park, 67 Gosport Street,
Lymington, Hampshire, SO41 9EG, UK
Tel: +44 (0) 1590 613500
Fax: +44 (0) 1590 613555
E-mail: anem@gill.co.uk
Website: www.gill.co.uk

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This range is in continuous development and therefore specifications may be subject to change without prior notice.

GILL INSTRUMENTS

R3-50

Ultrasonic Research Anemometer

R3-50

ALL WEATHER SENSING TECHNOLOGY

- *WIND TURBULENCE MEASUREMENT*
- *COMPONENT WIND VELOCITY UVW*
- *WIND PROFILING*
- *MAINTENANCE FREE*
- *ROBUST CONSTRUCTION*
- *50 Hz DATA RATE*
- *CUSTOM CALIBRATED*
- *ANALOGUE OUTPUTS*
- *SPEED OF SOUND AND SONIC TEMPERATURE OUTPUTS*

R3-50 - ULTRASONIC RESEARCH ANEMOMETER

The Solent Research R3-50 is a cost effective solution for projects requiring the benefit of Gill's proven experience in the production of ultrasonic anemometers for all weather applications. Robust and easy to use, the R3-50 employs the same software as the popular R3 range of sensors but with a data rate of 50 Hz.

If required the unit can be supplied with the optional Sensor Input Unit (for analogue inputs) and Power Supply (including analogue outputs).

Based on the highly successful range of Solent Research Anemometers, the R3-50 is ideal for users undertaking research with large eddies at high mast levels.

Having identical output formats to the R3, the R3-50 is particularly suited to applications where a complete wind profile is required, with an R3 or HS positioned near the ground and the R3-50 positioned at a higher level.

Gill research grade units are individually custom calibrated and supplied with a certificate of calibration. All of our test equipment has been designed specifically to test and calibrate our range or ultrasonic sensors and is traceable to national standards.

ULTRASONIC MEASUREMENT	
Ultrasonic output rate	50 Hz
Parameters	UVW, Speed of Sound
WIND SPEED	
Range & resolution	0 - 45 m/s, 0.01 m/s
Accuracy	< ± 1% RMS
DIRECTION	
Range & resolution	0 - 359, 1°
Accuracy *	< ± 1°
SPEED OF SOUND	
Range & resolution	300 - 370 m/s, 0.01 m/s
Accuracy	< ± 0.5% @ 20°C
DIGITAL OUTPUT	
Communication	RS422 full duplex, 8 data bits, 1 stop bit, no parity
Baud Rates	2400 - 115200
Output rate	Selectable 0.4 to $50s^{-1}$
ANALOGUE OUTPUTS (requires PCIA unit)	
Quantity	7 (U, V, W, SoS, PRT plus 2 analogue inputs)
Scale	± 10, ± 20, ± 30, ± 60 m/s
Update rate	0.4 to $50s^{-1}$
Range and resolution	± 2.5V, 14 bits
Accuracy	<0.1% of FSR
ANALOGUE INPUTS (requires SIU)	
Quantity	6 differential inputs
Sampling rate	$50s^{-1}$
Range and resolution	± 5V, 14 bits
Accuracy	<0.1% of FSR

PRT INPUT (requires SIU, PRT 100 not supplied)	
Input resolution	0.01°C
Input accuracy	<0.01°C (0 to 50°C) <0.15°C (-40°C to +60°C)
POWER REQUIREMENT	
Anemometer	9 - 30V dc (<150mA @ 24VDC or 300mA @ 12VDC)
ENVIRONMENTAL	
Operating temperature	-40°C to +60°C
Ingress protection	IP65
Precipitation	Operation maintained to 300mm/hr
EMC	BS EN 50081-1: 1992 (Emissions) BS EN 50082-1: 1997 (Immunity)
GENERAL	
Suitable for exposure to a marine environment	
MATERIALS	
External construction	Aluminium / Carbon Fibre
DIMENSIONS	
Size	750mm x 240mm
Weight	1 kg

* Accuracy specification applies for wind speeds <32 m/s and for wind incidence up to ± 20° from the horizontal

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Saltmarsh Park, 67 Gosport Street,
Lymington, Hampshire, SO41 9EG, UK
Tel: +44 (0) 1590 613500
Fax: +44 (0) 1590 613555
E-mail: anem@gill.co.uk
Website: www.gill.co.uk

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GILL INSTRUMENTS

R3-100

Ultrasonic Research Anemometer

R3-100

ALL WEATHER SENSING TECHNOLOGY

- *WIND TURBULENCE MEASUREMENT*
- *COMPONENT WIND VELOCITY UVW*
- *WIND PROFILING*
- *MAINTENANCE FREE*
- *ROBUST CONSTRUCTION*
- *100 Hz DATA RATE*
- *CUSTOM CALIBRATED*
- *ANALOGUE OUTPUTS*
- *SPEED OF SOUND AND SONIC TEMPERATURE OUTPUTS*
- *OPTIONAL ANALOGUE AND PRT INPUTS*

R3-100 ULTRASONIC WIND SENSOR

The R3-100 combines the latest electronic components with Gill Instrument Ltd's considerable experience in producing solid state ultrasonic anemometers for micrometeorological research.

It take as its pedigree the world leading Solent Research R2 which have been proven time and time again to be consistant and reliable instruments for the study of wind and its turbulance parameters.

The R3-100 has a faster response time, up to 100Hz, and operating system, RCOM, designed to be robust and simpler to use.

The resolution of the analogue outputs has been greatly improved to 14bits whilst the high accurancy and measurement resolution of the solent research has been maintained.

Optional extras such as the inclinometer are available as well as a sensor input unit to allow upto 6 analogue sensors plus a PRT100 input.

*Supplied Accesssories - RCOM operating system with a graphical interface (data presentation and storage; flux calculations); power supply (PCIA); Transit Case.

Optional Accessories - Analogue and PRT Inputs via Signal Interface Unit (SIU); Inclinometer.

ULTRASONIC MEASUREMENT	
Ultrasonic sampling rate	100Hz
Parameters	UVW, Speed of Sound
WIND SPEED	
Range and Resolution	0 - 45m/s, 0.01m/s
Accuracy	< ±1%RMS
DIRECTION	
Range and Resolution	0 - 360°, 1°
Accuracy*	< ±1°
SPEED OF SOUND	
Range and Resolution	300 - 370m/s, 0.01/s
Accuracy	< ±0.5%@20°C
DIGITAL OUTPUT	
Communication	RS422 full duplex, 8 data bits, 1 stop bit, no parity
Baud Rates	2400 - 115200
Output Rate	selectable 0.4 - 100Hz
ANALOGUE INPUTS (VIA OPTIONAL SIU)	
Quantity	6 differential inputs
Sampling Rate	100Hz
Input range / resolution	±5V, 14 bits
Accuracy	<0.1% of FSR
ANALOGUE OUTPUTS (VIA SUPPLIED PCIA)	
Quantity	7(U, V, W, SoS, PRT + 2 analogue inputs)
Sampling	±10, ±20, ±30, ±60m/s
Update rate	0.4 to 100Hz
Output range / res	±2.5V, 14 bits
Accuracy	<0.25% of FSR

PRT INPUT (REQUIRES OPTIONAL SIU, PRT100 NOT INCLUDED)	
Input resolution	0.01°C
Input accuracy	<0.01°C (from 0°C to 50°C), <0.15°C (from -40°C to +60°C)
INCLINOMETER (OPTIONAL)	
Range / Resolution	±20°, 0.01°
Null Repeatability	±0.15°
Accuracy	±0.3°(from -10° to 10° of inclination
POWER REQUIREMENT	
Anemometer	9-30VDC <4w(eg. <150mA @ 24VDC or 300mA @ 12VDC
ENVIRONMENTAL	
Operating Temp	-40°C to +60°C
Moisture Ingress	IP65
Precipitation	300mm / hr
EMC	BS EN 50081-1: 1992 (Emissions) BS EN 50082-1: 1992 (Immunity)

GENERAL

Suitable for exposure to a marine environment.

NOTE

*Accuracy specification applies for wind speeds <32m/s and for wind incidence <±150° in the horizontal plane and up to ±50° from the horizontal.

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HOSKIN SCIENTIFIC LIMITED

Hukseflux Solar Sensors

Hukseflux Thermal Sensors

LP02 pyranometer
(ISO-9060 Second Class)
Solar radiation sensor compliant with ISO and WMO standards

LP02-TR
Solar radiation sensor compliant with ISO and WMO standards, with integrated transmitter

LP02 / LI19
Portable solar radiation sensor, with read-out unit / datalogger

SR03 pyranometer
(ISO-9060 Second Class)
Fast response pyranometer (for PV application) compliant with ISO and WMO standards 1-sec. rapid response sensor

SR11 pyranometer
(ISO-9060 First Class)
First class pyranometer solar radiation sensor

SR11-TR
First class solar radiation sensor with integrated transmitter

SR12 pyranometer
(ISO-9060 First Class)
First class pyranometer for solar energy test applications

NR01 net radiometer
4 component net-radiation sensor, 4 component SW & LW sensor

RA01 radiometer
2 component radiation sensor
2 component SW & LW sensor

DR01 pyrheliometer
(ISO-9060 First Class)
First class pyrheliometer

DR02 pyrheliometer
(ISO-9060 First Class)
Fast response first class pyrheliometer with heated window, 1-sec. rapid response sensor

SRA01 albedometer
Albedometer compliant with ISO and WMO standards
2 Second Class SR01 model pyranometers mounted back-to-back on the same housing

IR02 pyrgeometer
Pyrgeometer with heating

IR02-TR
Pyrgeometer with heating, with integrated transmitte

www.hoskin.ca

Burnaby, British Columbia - (604) 872-7894 | Burlington, Ontario - (905) 333-5510 | Montreal, Quebec - (514) 735-5267

Hukseflux
Thermal Sensors

HFP01

HEAT FLUX PLATE / HEAT FLUX SENSOR

HFP01 is the world's most popular sensor for heat flux measurement in the soil as well as through walls and building envelopes. By using a ceramics-plastic composite body the total thermal resistance is kept small.

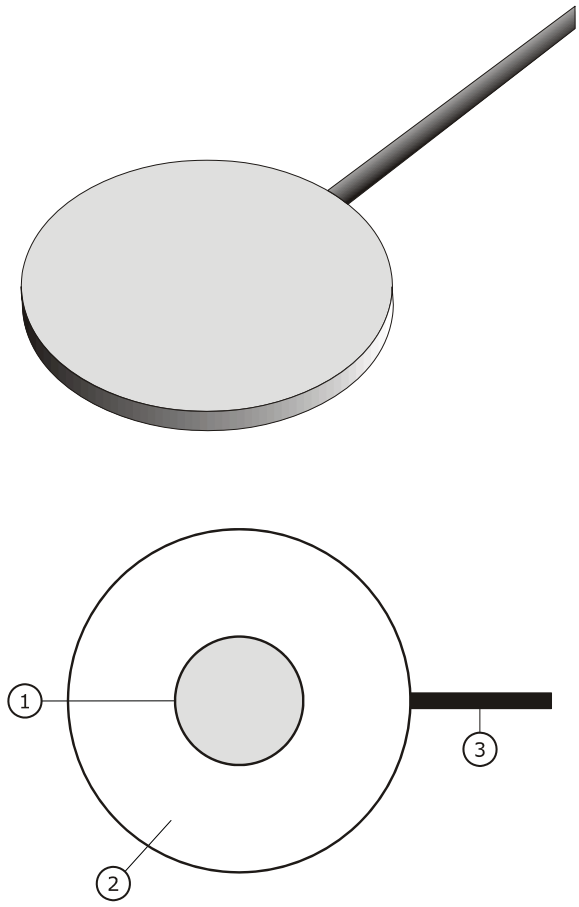


Figure 1 *HFP01 heat flux plate dimensions: (1) sensor area, (2) guard of ceramics-plastic composite, (3) cable, standard length is 5 m. All dimensions are in mm.*

HFP01 serves to measure the heat that flows through the object in which it is incorporated or on which it is mounted. The actual sensor in HFP01 is a thermopile. This thermopile measures the differential temperature across the ceramics-plastic composite body of HFP01. Working completely passive, HFP01 generates a small output voltage proportional to the local heat flux. Using HFP01 is easy. For readout one only needs an accurate voltmeter that works in the millivolt range. To calculate the heat flux, the voltage must be divided by the sensitivity; a constant that is supplied with each individual instrument. HFP01 can be used for in-situ measurement of building envelope thermal resistance (R-value) and thermal transmittance (H-value) according to ISO 9869, ASTM C1046 and ASTM 1155 standards.
Traceability of calibration is to the "guarded hot plate" of National Physical Laboratory (NPL) of the UK, according to ISO 8302 and ASTM C177.
A typical measurement location is equipped with 2 sensors for good spatial averaging. If necessary two sensors can be put in series, creating a single output signal.
If measuring in soil, in case a more accurate measurement is needed the model HFP01SC should be considered.

See also models HFP03 and the PU series.

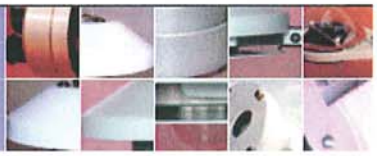
HFP01 SPECIFICATIONS

Sensitivity (nominal):	50 µV/ $W.m^{-2}$
Temperature range:	-30 to +70 °C
Sensor thermal resistance:	< 6.25 10^{-3} Km^2/W
Range :	+2000 to -2000 $W.m^{-2}$
Calibration traceability:	NPL, ISO 8302 / ASTM C177
Expected typical accuracy: (12hr totals)	within +5/- 15% in most common soils, within +5/ -5 % on walls

OPTIONS

Additional cable length x metres (add to 5m), AC100 amplifier, LI 18 hand held readout

MIDDLETON SOLAR
16 WILSON AVENUE BRUNSWICK VICTORIA 3056 AUSTRALIA



Short Form Catalogue

www.middletonsolar.com

Aug 2005

	DN5 & DN5-E First Class Pyrheliometer For solar direct radiation. ISO9060 First Class. Marine grade aluminium, hard anodised. Thermoelectric sensor, temperature compensated. Optional Filterwheel available.	Sensitivity: 7µV/W.m-2 (DN5) 1.0mV/W.m-2 (DN5-E) Spectral range: 0.2 to 5µm Response time: <10s to 95% DN5-E supply: 5.5-14.5VDC
	CN1-R Net Pyrradiometer For global & reflected total radiation balance. Semi-rigid polythene domes, permanently inflated; hermetically sealed construction; calibration certificate for shortwave & longwave.	Sensitivity: 25µV/W.m-2 Spectral range: 0.3 to 60µm SW to LW variation: <5% Up to down variation: <3% Response time: 45s to 95%
	SK01-D2 Pyranometer Moderate quality sensor for solar global radiation. Silicon photodiode detector. In-built amplifier. Circular level. Glass dome. Hard anodised. IP67. **SK01-DP2 PAR Sensor** Version of SK01-D2 for solar global Photosynthetically Active Radiation	Supply : 5.5-14.5 VDC, 3mA Spect. range: 0.3-1.15µm (SK01-D) 0.4 to 0.7µm (SK01-DP) Sensitivity: 1.0mV/W.m-2 (SK01-D) 0.5mV/µmol.s^{-1}.m-2 (SK01-DP) Directional resp: <±30W.m-2
	SK08 & SK08-E First Class Pyranometer Good quality sensor for solar global radiation. ISO9060 First Class. Hard anodised aluminium. Thermoelectric detector, temperature compensated. Complete with calibration cert. SK08-E has internal signal amplifier.	Sensitivity: 20µV/W.m-2 (SK08) 1.0mV/W.m-2 (SK08-E) Spectral range: 0.3 to 3µm Directional resp: <±20W.m-2 Response time: 11s to 95% SK08-E supply: 5.5-14.5VDC
	EQ08 & EQ08-E First Class Pyranometer High quality sensor for solar global radiation. ISO9060 First Class. Marine grade aluminium, hard anodised. Thermoelectric detector, temperature compensated. Complete with mount kit and calibration cert. EQ08-E has internal signal amplifier.	Sensitivity: 15µV/W.m-2 (EQ08) 1.0mV/W.m-2 (EQ08-E) Spectral range: 0.3 to 3µm Directional resp: <±20W.m-2 Response time: 11s to 95% EQ08-E supply: 5.5-14.5VDC
	EQ08-S, EQ08-SE Secondary Standard Pyranometer Very high quality sensor for solar global radiation. ISO9060 Secondary Standard. Thermoelectric detector, temperature compensated. EQ08-SE has internal signal amplifier.	Sensitivity: 17µV/W.m-2 (EQ08-S) 1.0mV/W.m-2 (EQ08-SE) Spectral range: 0.3 to 3µm Directional resp: < ±10W.m-2 Response time: < 15s to 95% EQ08-SE supply: 5.5-14.5VDC
	EQ16, EQ16-E Pyrano-Albedometer For ratio of upward to downward solar radiation. Comprises two matched response pyranometers on common body. EQ16-E has signal amplifier.	Specifications similar to EQ08 Separate Up/Down outputs
	UVR1-A & UVR1-B Ultraviolet Pyranometers UVR1-A (UVA 315-400nm) and UVR1-B (UVB 280-315nm). Low-noise signal amplifier. Active thermal stabilisation. Outputs for signal and temperature. Low power standby mode. Marine grade aluminium, hard anodised.	Supply: 5.5-14.5 VDC, 12W Sensitivity: 25mV/W.m-2 (UVR1-A) 500mV/W.m-2(UVR1-B) Resolution: <0.1% of fullscale Directional resp: < ±2% sideband error: 5% typical
	SD4 Sunshine Duration Sensor For accurate measurement of direct sunlight duration. Microcontroller evaluates contrast of four omni-directional sensors. No alignment required. Marine grade aluminium, hard anodised.	Supply : 5.5-14.5 VDC, 20mA Sun threshold: 120W.m-2 ±15% Uncertainity: <±0.1 hour Sunshine = +5V output No sunshine = 0V output
	CN3 Heat Flux Plate For conductive heat measurement (eg: in soil). Waterproof. Stainless steel with phenolic core. Complete with calibration certificate.	Sensitivity: 21µV/W.m-2 Ther. conductivity: 0.4W/m.°C Response time: 30s to 95% Temp. range: -20 to +70°C Temp. coeff: 0.2%/°C
	SP02 & SP02-L Sunphotometer For optical depth, column ozone, and water vapour measurement. Four narrow bandpass channels, axially aligned. Temperature output. Marine grade aluminium, hard anodised.	FOV: 5°(SP02); 2.5°(SP02-L) aerosol: 412, 500, 675, 862nm ozone: 368, 500, 610, 778nm water: 500, 778, 812, 862nm Response time: 0.2s to 95% Resolution: <0.005OD

Setting standards with the OTT Pluvio²

It does not matter whether it is drizzle or a cloudburst, sleet, hail or snow, the new **OTT** Pluvio² reliably and accurately measures both the amount and the intensity of liquid, solid, and mixed precipitation. It works according to the balance principle, taking account of external factors such as temperature and wind that could distort the results. Both digital outputs (impulse/0.1 mm and status) and the serial interface (freely configurable as SDI-12 or RS-485) are available for transferring the data.

High-precision technology and robust design provide high accuracy and complete reliability. Load cell and sensor electronics are reliably protected from damaging environmental influences. We have designed the carrier, bucket, and protective housing parts to be particularly robust and we have ensured the use of high-quality materials. And the best thing is: The OTT Pluvio² saves valuable time, as it not only provides precise precipitation data, but is also practically maintenance-free. How's that for a benchmark!

Ready for anything

When collecting climate data throughout the world, different demands are made regarding the bucket orifice of the rain gauge

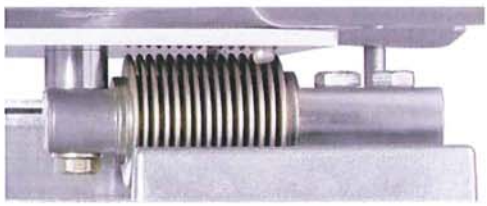
In accordance with the standards applicable in the world, we therefore offer the OTT Pluvio² in two versions.

OTT Pluvio² 200
Bucket orifice 200 cm², measuring capacity 1500 mm, ring heating optional

OTT Pluvio² 400
Bucket orifice 400 cm², measuring capacity 750 mm

The balance measuring process

Below the collecting bucket and well protected from damaging environmental factors, there is a high-precision, hermetically sealed load cell in stainless steel.



This measures the total weight on it. The sensor electronics attached use the measured value to calculate the net weight of the precipitation collected and to derive the temperature-compensated amount and intensity. An integrated temperature sensor provides the current environmental temperature at the time. The raw data obtained is subjected to a plausibility check by the OTT Pluvio². Factors affecting the result, such as wind, are eliminated by using a mathematical algorithm, thus providing adjusted precipitation data.

Innovative, professional, and practical

Developed in conjunction with technologically leading meteorological services, the OTT Pluvio² fulfills the highest expectations and at the same time stands out with relatively low operating costs. A price/performance ratio that will convince you.

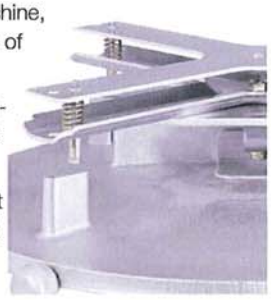
Accurate and stable long-term

- Fulfills all requirements of WMO manual 306, No. 8 (WMO = World Meteorological Organisation).
- Calibration of the load cell and sensor electronics is valid for the life of the unit.
- The individual temperature characteristic curve of the load cell is continually and drift-free compensated during the measurement.
- Measurement accuracy of ± 0.1 mm, for the whole life of the unit.

Non-sensitive and robust

The big plus of the OTT Pluvio² is its robust nature, which also resists adverse environmental conditions.

- The calculation electronics are hermetically protected from environmental influences and achieve the highest EMC.
- Formed parts are made by machine, they are particularly strong, and of high-quality materials.
- A cushioning spring system protects the load cell from damage from impact, for example.
- The electrical supply and output interfaces are protected against overload.



Suitable for any location

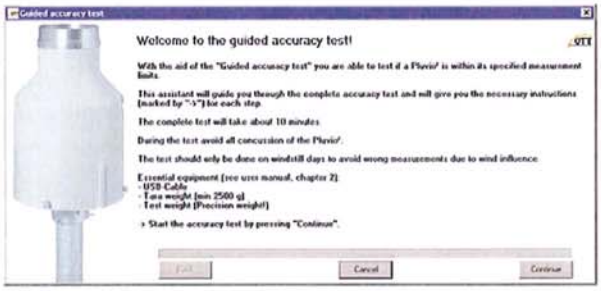
Conceived for a precipitation intensity range of 0.1 to 30 mm/min, the OTT Pluvio² reliably measures the drizzle of the temperate zones as well as heavy tropical rains and arctic snow showers.

- Bucket orifice without a funnel – heavy and solid precipitation are also recorded with precise timing.
- Continuous precipitation measurement and the highest availability of data – no evaporation losses from heated funnels or buckets.
- Anti-freeze prevents freezing – operation without compromise even in areas with high levels of snow and frost.
- Ring heating optionally available – no formation of snow caps.
- Possibility of power supply using solar energy – can also be used at self-sufficient measuring stations, even with snow and hail.

Virtually maintenance-free

The OTT Pluvio² is supplied with lifetime calibration. Calibration work on location is therefore no longer necessary.

- Maintenance work is limited to emptying the collecting bucket, occasional visual checks, and adding anti-freeze as necessary.
- Onerous cleaning work due to blocked funnels or filters are a thing of the past.
- Alarm and error messages are available for remote data transfer via the output interfaces – thus, an overflow, for example, can automatically be detected by the status.
- Data output is blocked during maintenance work and accuracy tests.



The OTT Pluvio² operating software is menu-driven and allows simple functional checks and accuracy tests on location using a notebook computer. The power supply is simply provided via USB.

Technical Data

General data		
Types of precipitation	liquid, solid, and mixed	
Collecting area	200 cm² and 400 cm²	
Collection volume	1500 mm and 750 mm	
Sensor element	sealed load cell	
Interfaces		
USB	configuration/service mode and firmware update	
Serial interfaces	SDI-12 or RS-485	
Digital outputs	impulse 0.1 mm and status (0 ... 120 impulses/min; configurable: 5 Hz or 2 Hz)	
Measurement output	intensity RT; amount RT/NRT, amount NRT, amount total NRT bucket content RT and NRT; temperature of load cell OTT Pluvio² status; heating status (if present)	
Electrical and mechanical data		
Power supply	9.6 ... 28 VDC	
Power/current consumption	≤ 180 mW / max. 15 mA at 12 V, typically 12 mA at 12 V	
Ring heating, optional	24 VDC / 50 Watt	
Dimensions (Ø x H)		
OTT Pluvio² 200 / OTT Pluvio² 400	450 mm x 740 mm / 450 mm x 660 mm	
Pedestal (Ø)	110-120 mm (4 ") (2" possible)	
Weight (bucket empty)	15 kg	
Material for base plate / bucket / pipe housing	aluminium / polyethylene / ASA, UV-resistant	
Environmental conditions		
Temperature, in operation	-40 ... +60 °C	
Temperature, storage	-50 ... +70 °C	
Relative humidity	0 ... 100 % (non-condensed)	
Protection		
Housing	IP 65, resistant to salt fog	
Load cell	IP 67	
EMC	complies with EN 61000-4-2/3/4/5/6, CE conformity	
Measuring range	**200**	**400**
Intensity RT / measuring interval 1 minute	12.00 ... 1,800.00 mm/h	6.00 ... 1,800.00 mm/h
	0.20 ... 30 mm/min	0.10 ... 30 mm/min
Amount RT /NRT, amount NRT, amount total NRT	0.10 ... 500.00 mm	0.10 ... 500.00 mm
Bucket content, RT and NRT	20.00 ... 1,600.00 mm	20.00 ... 850.00 mm
Accuracy (at - 25 ... +45 °C)		
Amount and bucket content, absolute (max. 60 min. collection time)	± 0.1 mm	
Intensity	± 0.1 mm/min or ± 6 mm/h	
Resolution	0.01 mm and 0.01 mm/min or mm/h	
Times		
Intensity output interval	1 minute	
Output delay	RT 18 seconds; NRT 5 minutes	
Query interval	6 seconds ... 60 minutes	
Pluvio² operating software		
(supplied with unit)	measured value display, configuration, diagnosis, firmware update, guided accuracy test	

RT = real-time; NRT = non real-time; units can be configured in mm or in (inch) and °C or °F

OTT – Your partner for:

- Water level measurement in ground and surface water
- Discharge measurement
- Precipitation measurement
- Water quality measurement
- Data management and communication
- HydroService: consulting, training, installation and maintenance

OTT MESSTECHNIK GmbH & Co. KG
Ludwigstrasse 16
87437 Kempten
Phone +49 (0)831/5617-0
Fax +49 (0)831/5617-209
info@ott.com
www.ott.com

We reserve the right to make technical changes and improvements without notice. 70.020.020.P.E Version: 03-04/2008

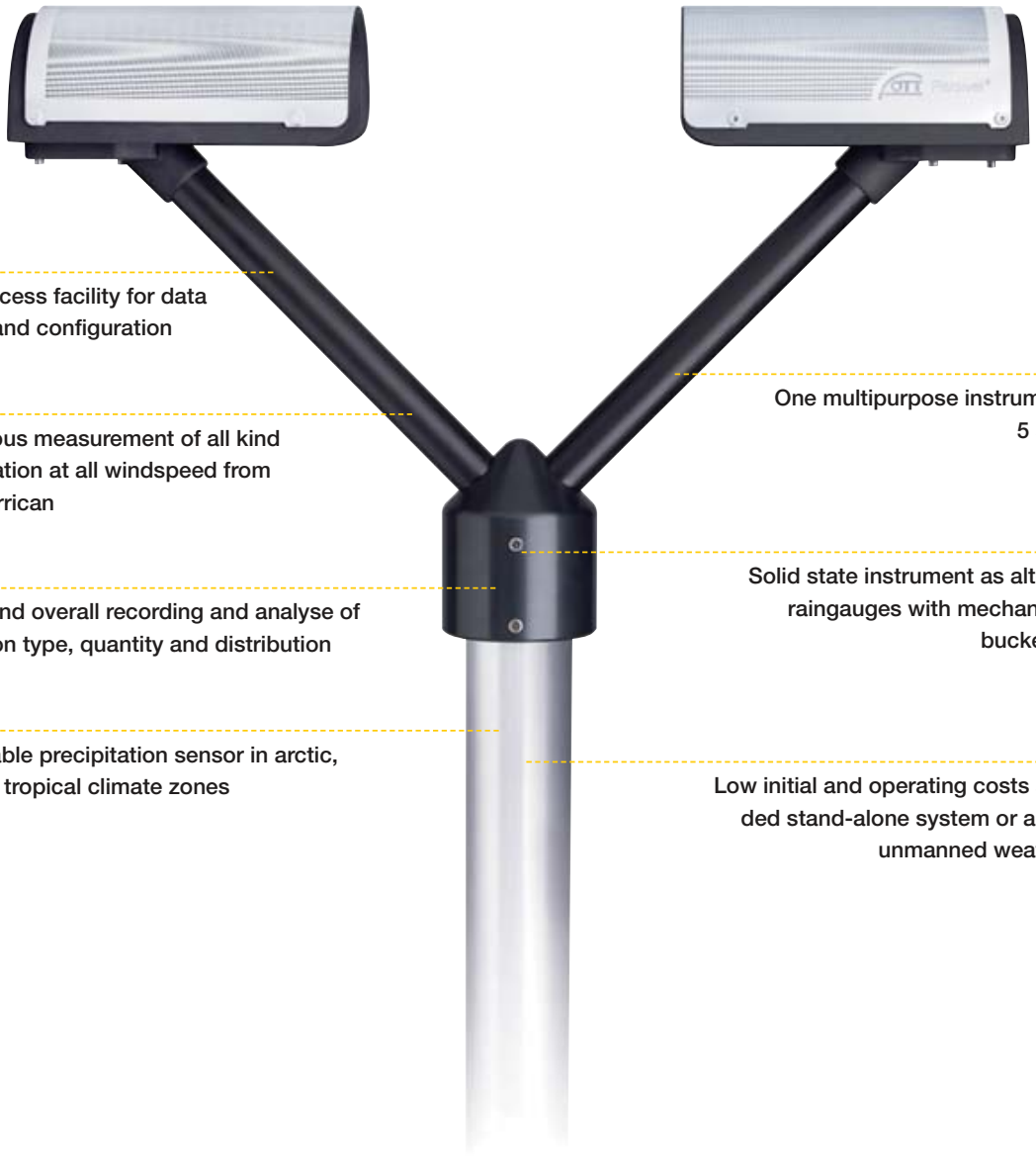
Measuring hydrometeors with Parsivel®

Parsivel is a modern, laser-based optical system for measuring all types of precipitation completely and reliably. Hydrometeors are differentiated and are classified as drizzle, rain, sleet, hail, snow and mixed precipitation.

Precipitation measurements are carried out with a special sensing head developed for this purpose. It detects precipitation optically one meter above ground-level (other heights are available on request). The data obtained are handled and stored by a fast digital signal processor:

Primary data are the size and velocity of each single hydrometeor, from which the size spectrum, the amount of rainfall, the equivalent radar reflectivity, the visibility, the precipitation kinetic energy and the precipitation type are derived. The results can be transmitted to a datalogger or a PC with a serial interface.

The advantages of Parsivel®



Remote access facility for data gathering and configuration

Simultaneous measurement of all kind of precipitation at all windspeed from calm to hurrican

Accurate and overall recording and analyse of precipitation type, quantity and distribution

Fully operable precipitation sensor in arctic, desert and tropical climate zones

One multipurpose instrument fits for 5 single units

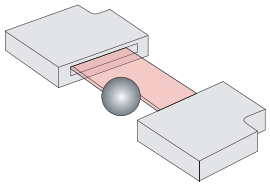
Solid state instrument as alternative for raingauges with mechanical tipping bucket principle

Low initial and operating costs as unattended stand-alone system or as part of an unmanned weather station

The principle

Parsivel uses a laser-based optical sensor to measure precipitation. The transmitter unit of the sensor generates a flat, horizontal beam of light, which the receiver unit converts into an electrical signal. This signal changes whenever a hydrometeor falls through the beam anywhere within the measurement area (54 cm^2).

The degree of dimming is a measure of the size of the hydrometeor, and together with duration of the signal, the fall velocity can be derived.



Parsivel® features unique performance

– Patented extinction measurement procedure
– Operates unattended and fast, using maintenance-free laser technology
– Reliable in all environmental and weather conditions (lightning protection and self-regulated heating)
– Low power and heating operation by software commands
– Reliable recognition of all precipitation types, including mixed precipitation in the melting layer
– Comprehensive precipitation analysis using 2-dimensional distribution of size and velocity
– Special measuring head prevents secondary spectra caused by drops splashing on the sensor head
– Transmitter and receiver head in perfect design with no obstacles for precipitation catching

5 systems in one unit

Up to five systems can be accommodated in a single unit using appropriate and efficient software to suit customer requirements.

Precipitation

Measurements designed for determining the distribution and amount of precipitation can be carried out maintenance-free with Parsivel, regardless of the intensity, duration or type of precipitation. Additionally, its composition – i. e. the distribution of particles with respect to their type – is obtained directly from the measured sizes and velocities of each single particle and is recorded statistically.

Present Weather Sensor (PWS)

The present weather and the types of precipitation (rain, drizzle, snow, hail and sleet) are classified in accordance with a weather-code established by the WMO. Unmanned weather stations require automatic detection, reliably and unambiguously. Parsivel can ascertain the type, quantity and composition of the hydrometeor and the atmospheric visibility – in every kind of weather!

Monitoring of disposal sites

The functions of precipitation kinetic energy distribution and precipitation measurement are utilised by Parsivel to record the effect of rain on the condition of the disposal sites in conjunction with other sensors, e. g. ground-condition probes.

Monitoring road conditions

Highly localised precipitation can lead to aquaplaning or packed snow on roads. Therefore, rapid traffic warning and control systems are necessary in order to prevent accidents. Precipitation measurement, hydrometeor composition and atmospheric visibility are of considerable importance in such systems. Parsivel is an integrated instrument that measures all these quantities.

Flood early warning

To assure a timely warning of impending high water it is necessary to measure the amount and spatial distribution of precipitation rapidly and accurately. This goal can be achieved by combining weather radar measurements (spatial information with reduced accuracy) and groundbased disdrometer measurements:
Parsivel provides drop size distributions on the ground and a function to derive a local Z/R relation – ready to be used to adjust the radar data. In combination with water level sensors and drainage modelling, a high-performance regional high water early warning system can be erected.

Technical data

Optical sensor, laser diode	Wave length 650 nm, 1 mW output power
Laser class	1 (21 CFR 1040.10 and 1040.11) 1M (IEC/EN 60825-1 A2:2001)
Beam size W x D	180 x 30 mm; 7.09 x 1.18 inch
Measuring area	54 cm^2 / 8.37 $inch^2$, statistical correction of border events
Range of measurement	
Particle size	0.2 … 25 mm / 0.008 … 0.98 inch
Particle velocity	0.2 … 20 m/s / 7.87 … 787.4 inch/s
Particle classification	32 size classes and 32 velocity classes
Precipitation types	8 (drizzle, drizzle/rain, rain, mixed rain/snow, snow, snow grains, sleet, hail)
Distinction of precipitation types	> 97 % compared with synoptic observer (drizzle, rain, hail, snow)
Precipitation intensity	0.001 ... 1200 mm/h / 0.00004 ... 47.2 inch/h
Rain rate	±5 % (liquid)/±20 % (solid)[1]
Reports	WMO 4680/4677 (SYNOP) 4678 (METAR) and NWS tables
Visibility in precipitation (MOR)	100 … 5000 m / 300 … 16,000 feet; ±10%[1]
Radar reflectivity Z	–9.9 ... 99 dBz; ±20%[1]
Measurement interval	15 seconds to 60 minutes
Power supply	10 … 36 V DC, reverse battery protection, software controlled heating device
Power consumption	6 W (electronics with dew heater) at 24 V DC 50 W, max. 2 A (heating device) at 24 V DC (configurable)[2]
Interfaces (configurable)[2]	RS 485 (1200 … 115, 200 Baud, half duplex), SDI-12, open-collector digital output for precipitation status (solid/liquid) and pulse (0.1 mm (0.004 inch) / 0.01 mm (0.0004 inch)
Overvoltage protection	EN 61000-4-2/4/5/6 (4 kV), integrated for power and interfaces lines
EMC / EMI	EN 61000-4-3, CE-conform
Material	Galvanized aluminium housing
Weight	Max. 5 kg
Temperature range	–40 … +70 °C / -40 … +158 °F; 0 … 100 % rH
Protection	IP 65, salt fog proof
Dimension W x H x D	560 x 370 x 120 mm / 22.05 x 14.57 x 4.72 inch
Mounting	On a tube, Ø 50 … 60 mm / 2 … 2.36 inch

[1] Accuracy applicable from firmware version 1.10.1; calibration ex factory implied; upgrade of previous versions possible

[2] ASDO configuration software included in delivery

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Ludwigstrasse 16
87437 Kempten
Tel. +49 (0)831/5617-0
Fax +49 (0)831/5617-209
info@ott.com
www.ott.com

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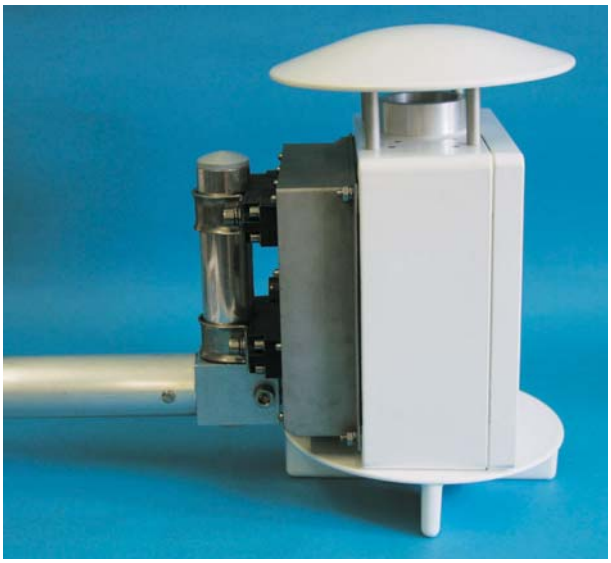
70.200.005.P.E As at: 06-06/2007

Ventilated thermohygrometer VTP37

- **meets the highest demands as to reliability and accuracy**
- **Ventilated, heated air-thermometer**
- **Automatically regulated mechanical cleaning of the dew point mirror for maintenance-free operation**
- **Connectable to PC, Modem, GSM**



Thermohygrometer VTP37 mounted electrically insulated on a meteomast outrigger. The air intake is at the bottom. The air leaves the housing by way of a duct below the lid.

VTP37 is the combination of the proven Thermohygrometer Thygan VTP6 and the control unit CU-VTP. The combination of this two instruments saves space and weight and helps reduce installation efforts.

The VTP37 is a ventilated, heated thermometer combined with a mirror-type dew point hygrometer. The instrument is designed for field Operation and meets the highest demands as to reliability and accuracy even under the most severe environmental conditions.

Its special features include:

Cyclic operation which allows automatic control and regulation of the most important functions. The VTP37 measures the air temperature and dew point temperature about ten times within 40 seconds every ten minutes. The instrument delivers the average values together with their standard deviations, allowing the quality of the data to be checked.

- For special applications, continuous operation can be selected by software command.
- The influence of moisture (psychrometric effect), radiation, icing, wind and electromagnetic interference (from radio transmitters) have been virtually eliminated.
- Low power consumption permits battery operation (without heater).
- Automatically regulated mechanical cleaning of the dew point mirror allows maintenance-free operation.
- Automatic differentiation between ice and water films on the mirror. The type of deposit is distinguished in the calculation of the relative humidity.
- The humidity measurements are supplied either as relative humidity over water or as dew point/frost point (selection by software command).
- Control identifier indicates the operating state of the sensor.
- VTP37 is using exactly the same measurement system as the VTP6 which is recommended as a working reference by World Meteorological Organization (WMO)
- The VTP37 is available with MeteoBus or RS232 interface

VTP37 Airport has additional abilitiy to detect Fog. Fog detection is made by measuring oversaturated water content, and reported in 3 Steps:

1=danger of fog

2=light fog (visibility ~150...300m)

3=heavy fog (visibility <150m)

Hofstrasse 92
CH-8620 Wetzikon
Internet: www.meteolabor.ch

meteolabor ag

Tel. +41 44 934 40 40
Fax +41 44 934 40 99
E-Mail: info@meteolabor.ch

Technical data

Measuring instrument

Temperature range	–50°C to +50°C
Dew point range	–65°C to +50°C
max. Dew point depression at 20°C	40 K
Sensor type	copper constantan thermoelements
Temperature resolution	0.1 K
Relative humidity resolution	0.1 %
Accuracy	± 0.15 K from –20°C to +50°C ± 0.25 K from –65°C to –20°C
Operating Voltages	10... 15 V DC / 48 VAC
Weight	9.5 kg

Data Storage

Data memory	approx. 3500 data records (corresponding to 10 minute measuresmentes for 24 days)
Modes of operation	4 diff. operating modes for convenient data access.

Power supply

Mains supply	12 VDC, 350 mA peak 140 mA mean value 48 VAC max. 3.6 A for heating

Control commands

Set the internal clock
Check the sensor status
Switch from normal to continuous operation
Check for special messages
Change address of the instrument

Interfaces

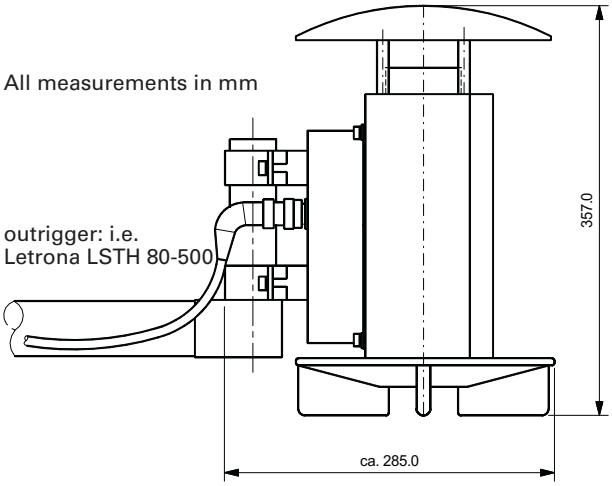
Baudrate	2400 bps (constant)
Norm	RS232 electrically isolated without hardware-handshake or RS485 electrically isolated (please specify when ordering)

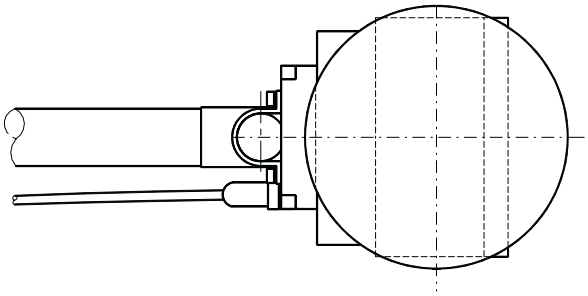
EMV

ESD	EN61000-4-2 8 kV contact-discharge 15 kV discharge through the air
Burst	EN61000-4-4 2 kV, 5/50 ns, 5 kHz
Surge	EN61000-4-5 Installation class 4

Dimensions

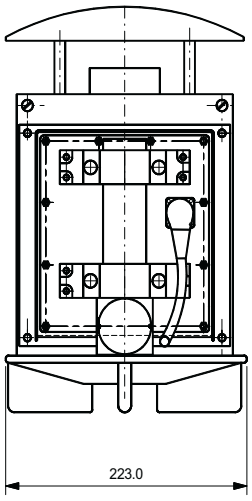
All measurements in mm





Details for ordering

- Thermo-Hygrometer VTP37, RS485: MGE-VTP37/00
- Thermo-Hygrometer VTP37, RS232: MGE-VTP37/01
- VTP37-Airport, RS485: MGE-VTP37/03
- VTP37-Airport, RS232: MGE-VTP37/02
- replacement fan including heating BGM-METEO/TP0169



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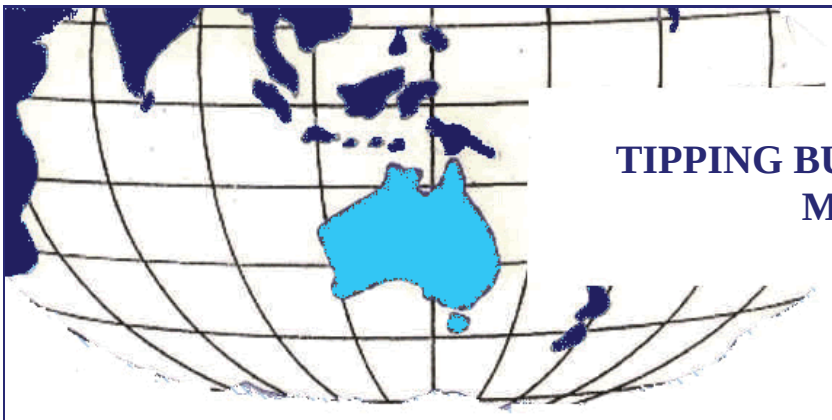
Hofstrasse 92
CH-8620 Wetzikon
Internet: www.meteolabor.ch

meteolabor ag

Phone +41 44 934 40 40
Fax +41 44 934 40 99
E-Mail: info@meteolabor.ch



Bulletin 52,
Edition 2

TIPPING BUCKET RAINGAUGE MODEL TB3

- **World standard 200mm catch**
- **Accuracy not affected by rainfall intensity**
- **Bucket sizes: 0.01 inch/ 0.2mm/ 0.5mm/ 1.0mm**
- **Long term stable calibration**
- **Stainless Steel leaf sieve filter resists blocking**
- **Optional internal Data Logger, with no external power requirement**
- **In-build discharge outlets at base for water collection and analysis**
- **Dual output signal for data collection and transmission**
- **World class meteorological instrument**
- **Easy to service with low maintenance requirement**

ISO 9001

QUALITY SYSTEM CERTIFIED

H S

HYDROLOGICAL SERVICES PTY.LTD.

HYDROLOGICAL INSTRUMENTS & EQUIPMENTS
DESIGNED AND MANUFACTURED
BY HYDROLOGISTS

Description

The Hydrological Services Tipping Bucket Raingauge is recognised as the world standard for measuring rainfall and precipitation in remote and unattended locations.
The integrated syphon mechanism delivers high levels of accuracy across a broad range of rainfall intensities. Each unit consists of a collector funnel with stainless steel leaf sieve, an integrated syphon control mechanism, an outer enclosure with quick release fasteners, and base which houses the tipping bucket mechanism.
The unit includes dual output reed switches with varistor protection as well as dual rainfall discharge outlets for water collection and/or analysis.
The bucket tips when precipitation of 0.01 inch, 0.2mm, 0.5mm or 1.0mm has been collected. Each tip is marked by a reed switch closure and sorted to a Data Logger and/or used by a Telemetry System.

The Tipping Bucket Raingauge can be used in conjunction with Hydrological Services data logger model ML1. The logger is rugged and compact, it records the date and time of occurrence of tips from the raingauge up to 100,000 events with 1 Second Resolution can be stored in the ML1's memory. The data is stored in a flash EPROM.

ML1-FL

The ML1 fits inside the model TB3 Raingauge. Its compact design makes it ideal for incorporation into any piece of equipment where intelligent data acquisition and logging are required.

Accessories

Description	***Part No.***
Data Logger	ML1/ML1-FL
RS232 to USB Converter	DL307
Field Calibration Device	TB320 / FCD
TB3 Heater Kit	TB323
TB3 Bird Guard	TB333
TB3 Pole Mounting Bracket	TB334

Specifications

Receiver:	200 mm ± 0.3 diameter machined aluminium rim. Powder coated.
Bucket capacity:	0.2 mm, 0.5 mm,1.0 mm, 0.01 inch of rainfall.
Sensitivity:	one tip.
Measuring range:	0 to 700 mm / hr.
Calibration accuracy:	± 2 % for intensities from 25 to 500 mm/hr. Long term stable calibration.
Humidity:	0 to 100 %
Temperature:	- 20 to +70•€
Contact system:	dual reed switches potted in soft silicon rubber with varister protection.
- Max Capacity:	12 VA (0.5 amp max.)
- Resistance:	Initial contact resistance 0.1 OHMS
- M.T.B.F:	10^8 to 10^9 Operations
Syphon:	0.4 mm capacity of rainfall - made from brass with a non hydroscopic outer case.
Bucket:	two types of buckets, synthetic ceramic coated brass bucket balanced to ±0.05 gms, and injection moulded non hydroscopic plastic ABS balanced ±0.05 gms.
Base:	Diecast aluminium.
Level:	bulls eye level adhered to aluminium base.
Mounting holes:	three 10 mm diameter mounting holes with 117 mm p.c.d. cast in feet attached to outside diameter of base.
Drain fittings:	to attach 12 mm inside diameter tubing, to catch rainfall after passing through buckets.
Pivots:	ground sapphire pivots with hard stainless steel shaft.
Insect covers:	stainless steel mesh on all openings to prevent insects and ants entering gauge.
Outer enclosure:	keyed to enable the release of the outer enclosure without the need for the removal of the three securing screws.
Height:	342mm
Weight:	3 kg

HYDROLOGICAL SERVICES PTY. LTD.

48-50 SCRIVENER STREET, WARWICK FARM, 2170 SYDNEY, AUSTRALIA.
A.B.N. 37 000 732 954
PO Box 332 Liverpool BC 1871
PH: 02 96012022 (INT.612 9601 2022)
FAX: 02 9602 6971 (INT.612 9602 6971)
Email: sales@hydrologicalservices.com
Website: www.hydrologicalservices.com

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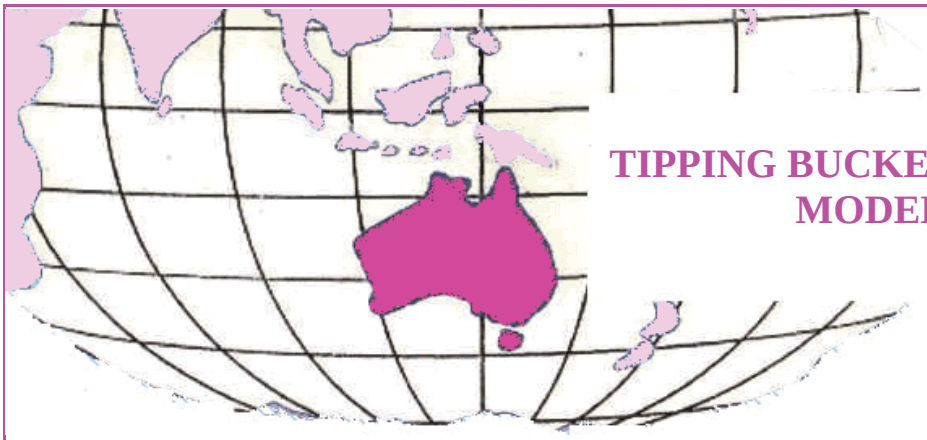
Bulletin 9G,
Edition 1



TIPPING BUCKET RAINGAUGE
MODEL TB6

- **World standard 200mm catch**
- **Bucket size: 0.01 inch/ 0.2mm/ 0.5mm**
- **Long term stable calibration**
- **Leaf filter resists blocking**
- **Optional internal Data Logger, with no external power requirement**
- **In-built discharge outlets at base for water collection and analysis**
- **Dual output signal for data collection and telemetry**
- **World class meteorological instrument**
- **Easy to service with low maintenance requirement**

(A)

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HYDROLOGICAL SERVICES PTY.LTD.

HYDROLOGICAL INSTRUMENTS & EQUIPMENTS
DESIGNED AND MANUFACTURED
BY HYDROLOGISTS

Description

The Hydrological Services Tipping Bucket Raingauge model TB6, is recognised as the world standard for measuring rainfall and precipitation in remote and unattended locations.

Each unit consists of a collector funnel with Leaf filter, an integrated flow control mechanism, an outer enclosure with quick release fasteners, and base which houses the tipping bucket mechanism.
The unit includes dual output reed switches with varistor protection as well as dual rainfall discharge outlets for water collection and/or analysis.
The bucket tips when precipitation of 0.01 inch, 0.2mm or 0.5mm has been collected. Each tip activates a reed switch closure which is detected by a Data Logger and/or Telemetry System.

The Tipping Bucket Raingauge can be used in conjunction with Hydrological Services data logger model ML1. The logger is rugged and compact, it records the date and time of occurrence of tips from the raingauge up to 100,000 events with 1 Second Resolution can be stored in the ML1's memory. The data is stored in a flash EPROM.

figure: TB6 base with ML1-FL logger Installed

The ML1 fits inside the model TB6 Raingauge. Its compact design makes it ideal for incorporation into any piece of equipment where intelligent data acquisition and logging are required.

Accessories

Description	***Part No.***
(A) TB3 Pole Mounting Bracket	TB334
(B) Field Calibration Device	TB320 / FCD
(C) Data Logger	ML1 or ML1-FL
(D) RS232 to USB Converter	DL307

Specifications

Receiver:	200 mm ± 0.3 diameter, injection moulded ABB.
Bucket capacity:	0.5 mm of rainfall.
Sensitivity:	one tip.
Measuring range:	0.2 mm, 0.5 mm or 0.01 inch of rainfall.
Calibration accuracy:	±2 % for intensities from 0 to 100 mm/hr. ±3% for intensities from 100 to 300 mm/hr Long term stable calibration.
Humidity:	0 to 100 %
Temperature:	- 20 to +70•€
Contact system:	dual reed switches potted in soft silicon rubber with varistor protection.
- Capacity:	0.5 amp, 12 Volts D.C.
- Resistance:	Initial contact resistance 0.1 OHMS
- M.T.B.F:	10^8 to 10^9 Operations
Bucket:	chrome plated injection moulded, ABS bucket balanced to ± 0.05 gms. Retains less than 0.2 ml of water in each bucket after tipping.
Base:	injection moulded non hydroscopic ABB.
Level:	bulls eye level fitted to base.
Mounting holes:	three 10 mm diameter mounting holes at 117 mm p.c.d. in feet moulded to outside diameter of base.
Drain fittings:	able to attach 12 mm inside diameter tubing, to catch rainfall after passing through buckets.
Bucket pivot system:	two stainless steel rolling bearings, mounted at 90 degrees to bucket axle.
Insect covers:	stainless steel mesh on all openings to prevent insects and ants entering gauge.
Outer enclosure:	keyed to enable the release of the outer enclosure without the need for the removal of the three securing screws.
Height:	300mm; Weight: 2 kg (4.4 lbs)
Packed Dimensions:	3.2 Kg (7 lbs), 0.03m^3

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A.B.N. 37 000 732 954
PO Box 332 Liverpool BC 1871
PH: 02 96012022 (INT.612 9601 2022)
FAX: 02 9602 6971 (INT.612 9602 6971)
Email: sales@hydrologicalservices.com
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Field Calibration Device

Description:
In response to field Hydrologists'' requests for a device to check the calibration of Tipping Bucket Raingauges in the field, Hydrological Services have developed a Field Calibration Device. It is a light, portable device that allows field calibration tests. Using this instrument will save field time and money. The advantage of using a Field Calibration Device is that the Tipping Bucket Raingauges can remain fixed in their location and are therefore only out of service for a very short period of time.
The Field Calibration Device has adopted the same basic principles as the Model TB340 Calibration Unit but operates in a slightly different manner. The Field Calibration Device nozzle is unscrewed from the cylinder, which is in turn filled with water to the very top. The nozzle is then screwed back on the cylinder and placed through the holding plate which sits on the catch of any Tipping Bucket Raingauge. When the cap on the Field Calibration Device is closed, the air is entrapped in the cylinder.
When the cap is removed a vacuum is created and the water is released down through the nozzle and into the Tipping Bucket Raingauge. A preset volume (653ml) water will discharge through the Tipping Bucket Raingauge. This process is to be repeated a second time for an accurate calibration check. The number of tips can be manually counted or stored on the data logger for calibration check evidence and then checked with ''Calibration Specifications'' to confirm that the results come within the acceptable range.

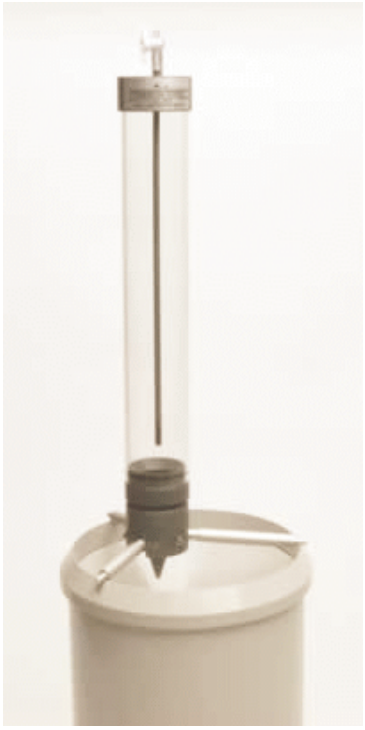

Figure: FCD

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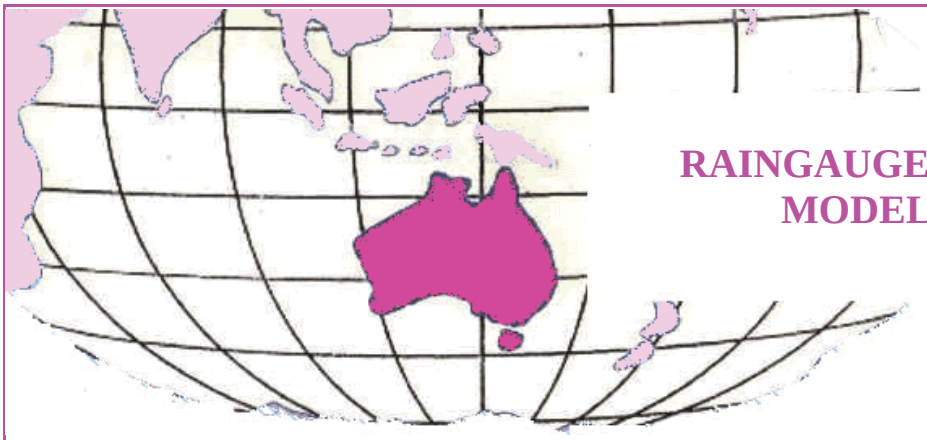
239 East 6th Ave, Vancouver BC V5T 1J7
Phone: (604) 872 7894 Fax: (604)872 0281
Email: salesv@hoskin.ca
Website: www.hoskin.ca



Bulletin 9F,
Edition 3

RAINGAUGE HEATER KIT
MODEL TBH-LP

- **Power Requirement AC/DC**
- **Low Power Consumption - Only Operating When Snow Is Detected**
- **Fully Automated Operation**
- **Thermostatically Controlled Heating Element**
- **SDI-12 Interface**

ISO
9001

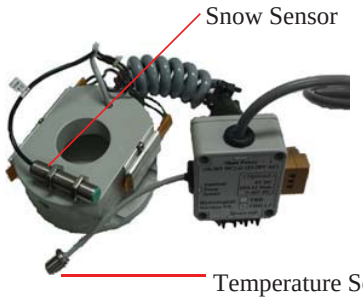
QUALITY SYSTEM
CERTIFIED

HYDROLOGICAL SERVICES PTY.LTD.

HYDROLOGICAL INSTRUMENTS & EQUIPMENT
DESIGNED AND MANUFACTURED
BY HYDROLOGISTS

DESCRIPTION

The Hydrological Services Tipping Bucket Heater has been designed for use with the Hydrological Services Tipping Bucket Raingauges. The device is a thermostatically controlled heating element, that raises the temperature of the interior of the raingauge, funnel and catch to avoid the freezing of the gauge in cold climates with subsequent loss of precipitation records. When the ambient temperature drops below a preset value (+ 4ºC), the snow sensor in the funnel is activated. The heating elements remain "OFF" until snow is detected in the catch area (funnel). The heating elements are turned on and off to keep the funnel temperature at the preset Setpoint temperature. (+ 10ºC) This will continue for a minimum preset time (18 mins) after there is no snow remaining in the catch. The heater will then be switched off and the unit will return to the "WAIT" mode until triggered by another snow event. The system will be de-activated when temperature drops below (-15 ºC) or above (+5 ºC) nominal.



The combination of snow sensor and thermostatic control of the heater element is designed to conserve power. The TB Heater is supplied ready to be installed with no settings required. The TB Heater incorporates an SDI-12 interface that allows the operator to configure, monitor and manually control the TB Heater – depending on the system requirements. (It is not mandatory to use the SDI-12 interface – but only optional if more detailed information or control is required.) The SDI-12 interface is optically isolated from the control electronics, because the control electronics may be operated from AC and therefore have separate earthing. The SDI-12 interface requires a separate 12V DC power source. For information relating to the TB3 Tipping Bucket Raingauge, refer to the TB3-100 Instruction Manual.

OPERATION

When the TB Heater is "not Active" the status LED flashes every 1.5 seconds. When the ambient temperature sensor detects the temperature fall below the "Active On temperature" (+4ºC) then the system becomes "Active" and the snow sensor is enabled. The status LED flashes slightly faster at 2 flashes per second – indicating the system is active. When the proximity sensor detects snow (for 5 seconds continuously), the heater elements are turned on and the block temperature sensor is monitored. The heaters are controlled so that the temperature inside the funnel reaches the Set Point temperature (+10ºC). The lower heating block keeps the tipping bucket and the drain tubes from freezing up. While the heater elements are turned on, the status LED flashes at 8 flashes per second. (For more information about the operation of the TB Heater please refer to the manual).

SPECIFICATIONS

Ambient temperature range
-40ºC to +70ºC (-40ºF to +158ºF)

Snow sensor and heater operating parameters
Between -15ºC to +4ºC (14ºF to 39ºF)

Average power generated
35 watts (150 watts during initial minute warm up)

Voltage requirements
Main Power: 10VDC to 30VDC OR
12VAC to 28VAC

SDI-12 Power: 9.6VDC to 16VDC (SDI-12 standard)

SDI-12 Interface optically isolated ,1200 baud, 7 bits, even parity.

Power generated and current requirements
- 12 VDC
- 45 watts average (70 watts when heater is on)
- 3.7 amps average (approx 65% duty cycle) (5.8 amps when the heater is on)

Average weekly energy consumption
Assume 4 x 10 hour snow storms in a week
- Energy = 4 x 10 x 45W = 1800 Watt hours / week
- AmpHours = 4 x 10 x 3.7A = 150 AmpHours (over 1 week)
- Which averages to 150Ah / (24 x 7) = 0.9 Amps Average over a week

Specifications are subject to change at anytime without notice.

HYDROLOGICAL SERVICES PTY. LTD.

48-50 SCRIVENER STREET, WARWICK FARM, 2170 SYDNEY, AUSTRALIA.
A.B.N. 37 000 732 954
PO Box 332 Liverpool BC 1871
PH: 02 96012022 (INT.612 9601 2022)
FAX: 02 9602 6971 (INT.612 9602 6971)
Email: sales@hydrologicalservices.com
Website: www.hydrologicalservices.com

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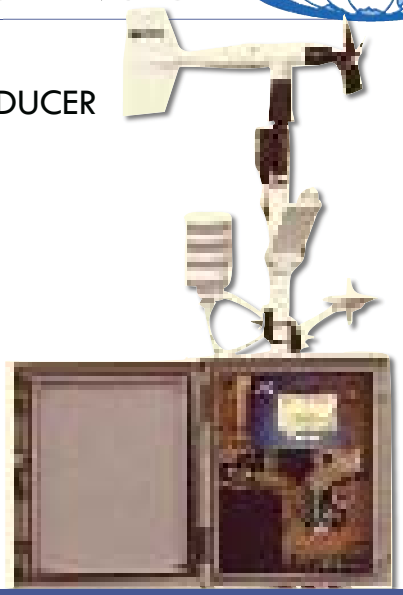
ACCUBAR®
BAROMETRIC PRESSURE SENSOR

HIGHLY ACCURATE, SOLID STATE PRESSURE TRANSDUCER



FEATURES

- Low power design makes it ideally suited for remote monitoring applications.
- Capable of operating from elevations of 1200 feet below sea level to 13,000 feet above sea level
- Wide temp range -45°C to +60°C
- Low power consumption
- Solid state construction
- Low cost
- Light weight aluminum construction
- RS-232, SDI-12, and Analog 0 - 5 VDC outputs

ORDERING

5600-0120-1

Pressure Sensor, Barometric, RS-232 and SDI-12 outputs

5600-0120-2

Pressure Sensor, Barometric, RS-232, SDI-12 and Analog 0-5VDC outputs

SPECIFICATIONS

Specifications subject to change without notice

RANGE	600 to 1100mB (hPa)
	17.7 to 32.5 in. Hg
ELEVATION	-1200 to 13,000 feet
ACCURACY	0.5mB (hPa) Consult factory for greater accuracy.
RESOLUTION	0.01mB
AV. TIME	0 to 240 seconds (user selectable)
TEMP RANGE	-45°C to +60°C
SUPPLY POWER	+8 to +28VDC (reverse polarity protected)
OUTPUT	Standard (-1) RS-232 and SDI-12
	Optional (-2) RS-232, SDI-12, and Analog 0-5VDC (accuracy 7mV)
RS-232 DATA	Continuous or on-demand
COMMUNICATION	1200 baud, even parity, 7 data bits, one stop bit
PRESSURE UNITS	mB, hPa, kPa, in. Hg, mm Hg, ATM, psi, user specified units

DIMENSIONS	3.14 in. x 2.95 in. x 2.24 in. excluding connectors and cable
WEIGHT	<1 lb
VIBRATION	0.5 g @ 10-50Hz
PRESSURE FITTING	Hose barb for 3/16 in. ID hose
ELECTRICAL CONNECTION	Cable gland for 1/4 in. cable to terminal block for 16 to 28 AWG wire

POWER CONSUMPTION

(-1) RS-232	active	17 mA typ
SDI-12	active	6 mA typ
	standby	2 mA typ
(-2) RS 232	active	18 mA typ
SDI-12	active	9 mA typ
	standby	8 mA typ

SUTRON
21300 RIDGETOP CIRCLE STERLING, VA 20166 WWW.SUTRON.COM
(703)406-2800 (703)406-2801 FAX SALES@SUTRON.COM

VAISALA www.vaisala.com

HMP155 Humidity and Temperature Probe

HMP155 with a new, stable HUMICAP®180R sensor and an additional temperature probe.

New probe for reliability

The new Vaisala HUMICAP® Humidity and Temperature Probe HMP155 provides reliable humidity and temperature measurement.

Long-term stability

The HMP155 has a new generation Vaisala HUMICAP®180R sensor that has excellent stability and withstands well harsh environments. The probe structure is solid and the sensor is protected with a sintered teflon filter, which gives maximum protection against liquid water, dust, and dirt.

Warmed probe and high humidity environment

Measuring humidity reliably is challenging in environments where humidity is near saturation. Measurements may be corrupted by fog, mist, rain, and heavy dew. A wet probe may not give an accurate measurement in the ambient air.

This is an environment to which Vaisala has designed a patented, warmed probe for reliable measuring. As the sensor head is warmed continuously, the humidity level inside it stays below the ambient level. Thus, it also reduces the risk of condensation forming on the probe.

Fast temperature measurement

What's more, with its fast response time, the additional temperature probe for the HMP155 is ideal for measurement in environments with changing temperatures.

Features/Benefits

- Vaisala HUMICAP®180R sensor - superior long-term stability
- Optional warmed humidity probe
- Plug-and-play
- Chemical purge
- USB connection for service use
- Installation kits for DTR13 and DTR502 radiation shields and also for a Stevenson screen
- Weather-proof housing IP66
- New, fast temperature probe
- Different output possibilities: voltage, RS-485, resistive Pt100
- Applications: meteorological applications, aviation and road weather, instrumentation

Long lifetime

Protecting the sensor from scattered and direct solar radiation, and precipitation will increase its lifetime. Thus, Vaisala recommends installing the HMP155 in one of the following radiation shields: DTR503, DTR13, or a Stevenson screen.

Easy maintenance

The probe can be calibrated using a pc with a USB cable, with the push buttons, or with the MI70 indicator.

Technical data

Performance

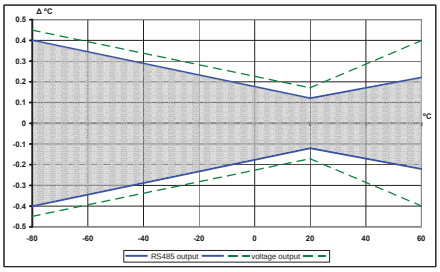
RELATIVE HUMIDITY	
Measurement range	0 ... 100 %RH
Accuracy (incl. non-linearity, hysteresis and repeatability) at	
+15 ... +25 °C (+59 ... +77 °F)	±1 %RH (0 ... 90 %RH)
	±1.7 %RH (90 ... 100 %RH)
-20 ... +40 °C (-4 ... 104 °F)	±(1.0 + 0.008 x reading) %RH
-40 ... -20 °C (-40 ... -4 °F)	±(1.2 + 0.012 x reading) %RH
+40 ... +60 °C (+104 ... +140 °F)	±(1.2 + 0.012 x reading) %RH
-60 ... -40 °C (-76 ... -40 °F)	±(1.4 + 0.032 x reading) %RH
Factory calibration uncertainty (+20 °C /+68 °F)	±0.6 %RH (0 ... 40 %RH)* ±1.0 %RH (40 ... 97 %RH)*
* Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.	
Recommended humidity sensor	HUMICAP®180R(C)
Response time at +20 °C in still air with a sintered PTFE filter	
63 %	20 s
90 %	60 s
TEMPERATURE	
Measurement range	-80 ... +60 °C (-112 ... +140 °F)
Accuracy with voltage output at	
-80 ... +20 °C	±(0.226 - 0.0028 x temperature) °C
+20 ... +60 °C	±(0.055 + 0.0057 x temperature) °C
passive (resistive) output according to IEC 751 1/3 Class B	±(0.1 + 0.00167 x |temperature|)°C
RS485 output	
-80 ... +20 °C	±(0.176 - 0.0028 x temperature) °C
+20 ... +60 °C	±(0.07 + 0.0025 x temperature) °C
Accuracy over temperature range (opposite)	
Temperature sensor	Pt100 RTD 1/3 Class B IEC 751
Response time with additional temperature probe in 3 m/s air flow	
63 %	<20 s
90 %	<35 s
OTHER VARIABLES	
dewpoint/frost point temperature, wet bulb temperature, mixing ratio	

General

Operating temperature range	-80 ... +60 °C (-112 ... +140 °F)
Storage temperature range	-80 ... +60 °C (-112 ... +140 °F)
Connection	8-pin male M12 connector
Connection cables	3.5, 10, and 30 m
Cable material	PUR
Wire size	AWG26
Service cables	USB connection cable MI70 connection cable
Additional T probe cable length	2 m
Housing material	PC
Housing classification	IP66
Sensor protection	sintered PTFE
Weigth (probe)	86 g
Electromagnetic compatibility: Complies with the EMC standard EN61326-1, Electrical equipment for measurement control and laboratory use - EMC requirement for use in industrial locations	

Inputs and outputs

Operating voltage	7 ... 28 VDC*
*Note: minimum operating voltage 12 V with 0 ... 5 V output and 16 V with 0 ... 10 V output, probe heating, chemical purge or XHEAT.	
Outputs	
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
resistive Pt100 (4-wire connection)	
RS485	
Average current consumption (+15 VDC, load 100 kOhm)	
0 ... 1 V output	<3 mA
0 ... 10 V output	+0.5 mA
RS485	<4 mA
during chemical purge	max. 110 mA
with warmed probe	max. 150 mA
Settling time at power-up	
voltage output	2 s
RS485	3 s



VAISALA

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CE

RAD 01 & RAD 02
Unaspirated Radiation Shields

METSPEC
SPECIALIST METEOROLOGICAL EQUIPMENT

A cross-sectional cutaway showing the external and internal louvres of a RAD 01 shield

Specifications

- Double louvred high impact thermoplastic
- White external layer, with U.V. stabiliser for long-term weather resistance
- Extra black internal layer
- Aluminium arm with durable white powder coating
- A4 grade (316), stainless steel 'V' bolt, and securing nuts to fit a pole of between 25-51 mm diameter
- Black acetal plastic locating clamp

Accuracy

Testing of these Shields has been carried out by Campbell Scientific Ltd, UK and the results are published with their kind permission:

Typical solar heating errors:
In conditions of high solar radiation and wind speeds less than 1 m/s the readings were compared with an aspirated shield
RAD 01 Small version: +0.75 °C
RAD 02 Large version: +0.5 °C
These errors are less than half those recorded from other similar shields on the market and the performance is comparable to the Stevenson screens, although the time constant of our new shields is shorter.
Detailed report on the trial is available from Metspec

Probe compatibility

RAD 01:
Houses probes from 5-12 mm in diameter with up to 120 mm of the probe inside the shield.
RAD 02:
Houses larger probes 14-25 mm.

Dimensions and weight:

RAD 01:
Overall 165 mm diameter x 172 mm height
(Shield only); 303 mm including bracket. Weight 1.05 kg
RAD 02:
Overall 165 diameter x 274 mm height
(Shield only); 405 mm including bracket. Weight 1.34 kg

RAD 01 & RAD 02
Unaspirated Radiation Shields

METSPEC
SPECIALIST METEOROLOGICAL EQUIPMENT

Introducing our new range of Radiation Shields, designed to house temperature and humidity probes and protect them from the heating effects of solar radiation and direct exposure to rain and snow.

Benefits over existing models on the market include:

- Improved accuracy proven in recent comparison trials
- Unique double louvred construction
- Highly durable, non yellowing, UV stable plastic
- Accommodates complete range of sensor sizes

Radiation Shields

Metspec Radiation Shields have an innovative design to reduce overheating when solar radiation is high and windspeed is low. This is also effective in the winter when the sun's angle is low or there is reflection off snow.

The design of the shield has a white outer reflective surface combined with an inner barrier of non-reflective, black louvres. This prevents sunlight and reflected radiation reaching the sensor whilst still allowing air to flow across the sensor. This design is based on the Metspec Stevenson Screen which is now established as an industry standard and sold to National Meteorological Services worldwide.

Trials carried out over the past year have confirmed that errors under adverse conditions are typically half those compared to similar shields.

Key Features

- Accuracy in trials comparable to Stevenson Screens
- Less sensitive to rainfall
- Improved protection against wind blown precipitation
- Secure sensor installation with stable mounting mechanism
- Durable UV stable plastic
- No power required

P.O. Box 26, FIN-00421 Helsinki, FINLAND
Tel: +358 9 894 91
Fax: +358 9 8949 2485
Email: industrialsales@vaisala.com
www.vaisala.com

Vaisala Weather Transmitter WXT510
The Most Essential of Weather

The Vaisala Weather Transmitter WXT510 makes building weather stations easier than ever. It combines decades of experience and the latest innovations on weather instruments into a compact and durable package.

Features/Benefits

- Six most essential weather parameters combined in one instrument
- Accurate and stable measurement
- Proven Vaisala sensor technology:
- Vaisala WINDCAP® Ultrasonic Wind Sensor for wind speed and direction
- Vaisala RAINCAP® Sensor for advanced precipitation measurement
- Vaisala BAROCAP® Sensor for barometric pressure
- Vaisala THERMOCAP® Sensor for temperature
- Vaisala HUMICAP® Sensor for relative humidity
- No moving parts
- Low power consumption
- Compact and light weight
- Fast and simple to install
- Low maintenance
- WXT Configuration Tool for PC

The Vaisala Weather Transmitter WXT510 is a compact and lightweight multi-sensor instrument that measures the most essential weather parameters. It is a configurable product that can measure wind speed and direction, liquid precipitation, barometric pressure, temperature and relative humidity — all in one transmitter.

Affordable weather intelligence

The demand for accurate weather information is constantly increasing. In addition to professional meteorology, there are also numerous businesses that are weather sensitive, even though measuring the environment is not their actual core operation.

To meet the growing needs for easy-to-access weather data, the Vaisala Weather Transmitter WXT510 has been developed. It combines the modern sensor technology, advanced design and decades of experience in environmental measurements resulting a high quality instrument that reliably measures all essential weather parameters. This makes the WXT510 an optimal building block for dense weather measurement networks, and other weather stations used in multiple applications.

The WXT510 is truly flexible and it can be configured to meet most user requirements. The transmitter is easy to install with its one-bolt-mounting method. Easy and fast installation, as well as low power consumption make it ideal for use in weather stations or applications where light weight and compactness are an advantage. As the WXT510 has no moving parts, it is durable and has long maintenance intervals. The materials used are also highly resistent against UV radiation and corrosion.

Proven Vaisala technology

Accurate measurement begins with the sensors. Vaisala has decades of experience in designing and manufacturing weather sensors with field proven reliability and accuracy.

Accurate and Stable Measurement

Wind measurement

Both wind speed and direction are measured using the advanced Vaisala WINDCAP® Sensor. The sensor uses ultrasound to determine horizontal wind speed and direction. The array of three equally spaced ultrasonic transducers on a horizontal plane is an ideal, Vaisala proprietary design. The design ensures accurate wind measurement from all wind directions, without blind angles or corrupted readings.

The wind sensor has no moving parts, which makes it maintenance free. The measurement range for wind speed is from 0 to 60 m/s and for wind direction from 0 to 360°.

Precipitation measurement

The precipitation measurement is based on the Vaisala RAINCAP® Sensor, which detects the impact of individual rain drops. The signals exerting from the impacts are proportional to the volume of the drops. Hence, the signal from each drop can be converted directly to the accumulated rainfall.

Compared to traditional precipitation gauges, the Vaisala RAINCAP® Sensor gives more detailed information about precipitation. The WXT510 measures accumulated rainfall, rain intensity and duration of the rain — all in real time. Due to the measurement method, flooding, clogging as well as wetting and evaporation losses in rain measurement are eliminated.

The Vaisala RAINCAP® Sensor is the only maintenance-free precipitation sensor on the market.

The WXT510 measures accumulated rain fall, rain intensity and duration of the rain in real time.

The patented ultrasonic based Vaisala WINDCAP® Sensor ensures accurate wind measurement from all wind directions.

Barometric pressure, temperature and humidity sensors are combined in an advanced PTU module placed inside the specially designed radiation shield.

PTU module for barometric pressure, temperature and humidity

Barometric pressure, temperature and humidity measurements are combined in an advanced PTU module utilizing capacitive measurement method for each parameter.

Barometric pressure is measured using the silicon-based Vaisala BAROCAP® Sensor. The sensor has minimal hysteresis and excellent repeatability, as well as outstanding temperature and long-term stability. The measurement range for pressure is from 600 to 1100 hPa.

Temperature measurement is based on the ceramic Vaisala THERMOCAP® Sensor. The measurement range is from -52 to +60 °C.

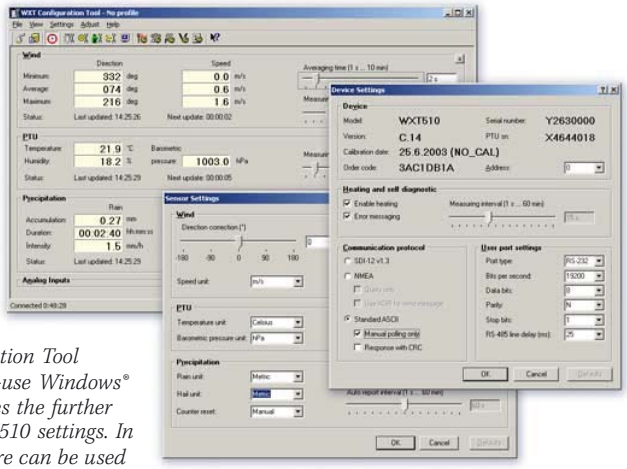
Humidity measurement is based on the Vaisala HUMICAP® technology. The Vaisala HUMICAP® Sensor is highly accurate and it offers excellent long-term stability in a wide range of environments and negligible hysteresis. The measurement range for humidity is 0...100 %RH.

The whole PTU module is replaceable and available as a spare part.

The PTU module is mounted in a specially designed radiation shield. The shield protects the sensors from both scattered and direct solar radiation and precipitation. The plastic material in the plates offers excellent thermal characteristics and UV stabilized construction. The white outer surface reflects radiation, while the black inside absorbs accumulated heat.

P.O. Box 26, FIN-00421 Helsinki, FINLAND
Tel: +358 9 894 91
Fax: +358 9 8949 2485
Email: industrialsales@vaisala.com
www.vaisala.com

Simple to Install, Easy to Integrate



The WXT Configuration Tool includes an easy-to-use Windows® software that enables the further adjustment of WTX510 settings. In addition, the software can be used as a WXT510 user interface / display in a PC environment.

Heating to ensure constant data availability

In order to have measurement data constantly available and ensure correct measurement also during snowfall, the WXT510 offers heating for the wind and rain sensors. The heating circuit is separate from the operational power, which makes it possible to use separate supplies. The nominal input level for heating voltage is 12 V or 24 V (with automatic switch-over), either DC, AC or rectified AC. The WXT510 has an automatic control circuit that switches the heating on only at low temperatures.

Low power consumption and wide input voltage range

The Vaisala Weather Transmitter WXT510 is an excellent choice for applications where power consumption is a critical factor. During the idle mode the device typically consumes less than 0.1 mA.

The WXT510 has a wide input voltage range. Any 5... 30 VDC power supply can be used as long as it meets all applicable safety regulations.

Easy settings

The WXT510 is supplied pre-configured from the factory. If the factory settings are needed to be altered, the user friendly configuration tool, Windows® based WXT Cofiguration Tool, is available. Averaging times, output mode settings etc. are easy to change if required. The WXT Configuration Tool can also be used as a display for the WXT510 transmitter.

Flexible output options

The Vaisala Weather Transmitter WXT510 communicates with the host via a bi-directional serial line. It offers a choice of four configurable serial interfaces: SDI-12, RS-232, RS-485 and RS-422.

The screw terminals inside the bottom part of the transmitter are easy to access. For extra convenience an industry standard 8-pin M12 connector at the bottom of the transmitter is available as an option.

Easy installation

The Vaisala Weather Transmitter WXT510 has been designed considering easy installation. After assembling the calibratd PTU module, the WXT510 only needs to be mounted, aligned, and connected to the data logger and the power source.

The WXT510 can be mounted either on top of a pole mast or on to a cross arm. In both cases the mounting procedure is very simple. For facilitating the installation to the pole mast and eliminating the risk of misalignment during the use an optional mounting kit is available. With the mounting kit the north alignment needs to be performed only once.

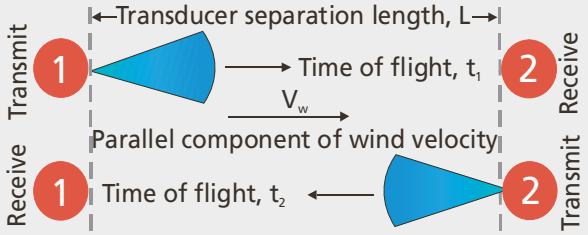
Negligible maintenance need

The Vaisala Weather Transmitter WXT510 is calibrated at the factory and requires very little maintenance. The only maintenance actions are cleaning the transmitter when necessary and replacing the PTU module. Both rain and wind measurements are practically calibration free. The PTU unit has a recommended calibration interval of two years.

Technical Data

Operating Principle

Vaisala WINDCAP® Sensor

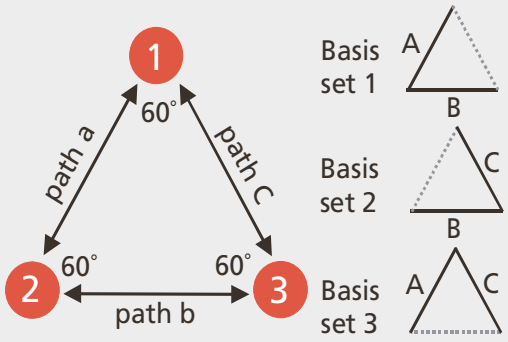


For static speed of sound V_s: $\frac{1}{t_1} = \frac{V_s + V_w}{L}$ and $\frac{1}{t_2} = \frac{V_s + V_w}{L}$

Combine to remove V_s: $V_w = \frac{L}{2}\left(\frac{1}{t_1} - \frac{1}{t_2}\right)$

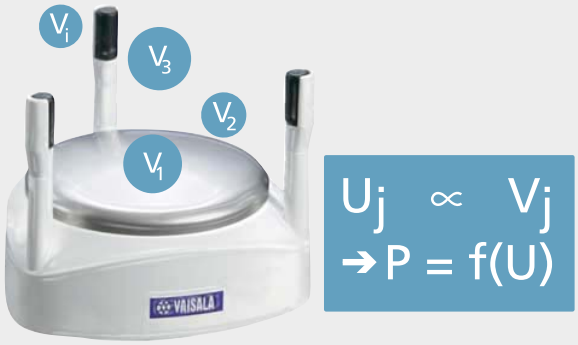
Solve for V_w

Time-of-flight for a sonic impulse from the transmit transducer to the receive transducer is determined for both directions. Simple algebra allows solving for the parallel component of wind velocity independently of the static speed of sound.



The equilateral triangle configuration of the three transducers provides three possible sets of basis vectors. The combinations yield bi-directional measurements on the paths labeled A, B and C. These measurements are used to determine the wind velocity components parallel to each of the three paths.

Vaisala RAINCAP® Sensor



The precipitation sensor detects the impact of individual raindrops. The voltage signals U_j resulting from the impacts are proportional to the volume of the drops V_j and therefore, the signal of each drop can be directly converted to accumulated precipitation P.

Wind

Wind speed

Range	0...60 m/s
Response time	0.25 s
Available variables	average, maximum and minimum
Accuracy	± 0.3 m/s or ±2% whichever is greater
Output resolution	0.1 m/s (km/h, mph, knots)
Units available	m/s, km/h, mph, knots

Wind direction

Azimuth	0...360°
Response time	250 ms
Available variables	Average, maximum and minimum
Accuracy	± 2°
Output resolution	1°

Measurement frame

Averaging time	1...600 s (= 10 min), at one second steps on the basis of 0.25 second samples
Update interval	1...3,600 s (= 60 min), at one second steps

Liquid Precipitation

Rainfall — cumulative accumulation after latest automatic or manual reset

Collecting area	60 cm^2
Output resolution	0.01 mm (0.001 in)
Accuracy	5% *
Units available	mm, in

Rain duration — counting each ten second increment whenever droplet detected

Ouput resolution	10 s

Rain intensity — one minute running average in ten second steps

Range	0...200 mm/h (broader range with reduced accuracy)
Ouput resolution	0.1 mm/h (0.01 in/h)
Units available	mm/h, in/h

Hail — cumulative amount of hits against collecting surface

Output resolution	0.1 hits/cm^2 (1 hits/in^2)
Units avaiable	hits/cm^2, hits/in^2, hits

Hail duration — counting each ten second increment whenever hailstone detected

Output resolution	10 s

Hail intensity — one minute running average in ten second steps

Output resolution	0.1 hits/cm^2h (1 hits/in^2h)
Units available	hits/cm^2h, hits/in^2h, hits/h

* Due to the nature of the phenomenon, deviations caused by spatial variations may exist in precipitation readings, especially in short time scale. The accuracy specification does nor include possible wind induced error.

PTU module =Barometric Pressure, Air Temperature and Relative Humidity

Barometric Pressure

Range	600...1 100 hPa
Accuracy	±0.5 hPa at 0...+30 °C (+32...+86 °F) ±1 hPa at -52...+60 °C (-60...+140 °F)

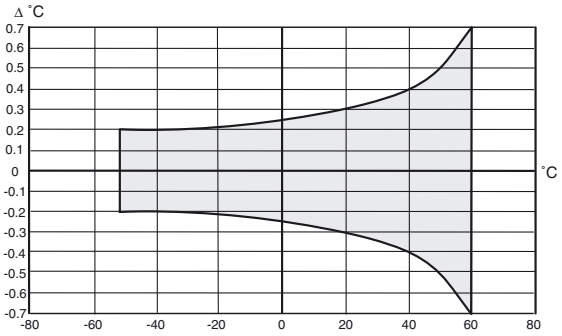
Technical Data, Dimensions

Output resolution	0.1 hPa, 10 Pa, 0.0001 bar, 0.1 mmHg, 0.01 inHg
Units available	hPa, Pa, bar, mmHg, inHg

Air Temperature

Range	-52 ... +60 °C (-60...+140 °F)
Accuracy (for sensor element) at +20 °C (+68 °F)	±0.3 °C (±0.5 °F)

Accuracy over temperature range (see graph)



Output resolution	0.1 °C (0.1°F)
Units available	°C, °F

Relative Humidity

Range	0...100 %RH
Accuracy	±3 %RH within 0...90 %RH ±5 %RH within 90...100 %RH
Output resolution	0.1 %RH

PTU Update Interval

Update interval	3...3 600 s (= 60 min), at one second steps

General

Self-diagnostic	separate supervision message, unit/status fields to validate measurement quality
Start-up	automatic, <10 seconds from power on to the first valid output
Communication protocols	SDI-12 v1.3, ASCII automatic & polled, NMEA-0183 v3.0 with query option
Port H/W	SDI-12, RS-232, RS-485, RS-422
Baud rate	1 200, 2 400...115 200
Operating temperature	-52...+60 °C (-60...+140 °F)
Storage temperature	-60...+70 °C (-76...+158 °F)
Operating humidity	0...100 %RH
Dimensions	
Height	240 mm (9.4 in)
Diameter	120 mm (4.7 in)
Weight	650 g (1.43 lbs)

Power Supply

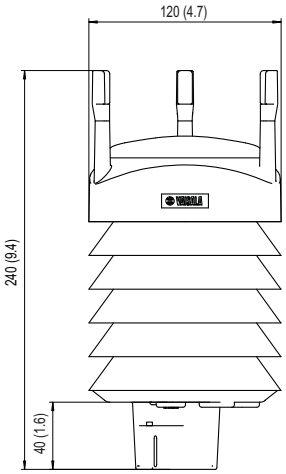
Input Voltage	5...30 VDC
Power consumption on average	
minimum	0.07 mA @ 12 VDC (in SDI-12 mode)
maximum	13 mA @ 30 VDC (with continuous measurement of all parameters)
typical	3 mA @ 12 VDC (with default measuring intervals)
Heating voltage	options: DC, AC, full wave rectified AC
recommended ranges	12 VDC ±20%, 1.1 A max. 24 VDC ±20%, 0.6 A max. 68 V_{p-p} ±20% (AC), 0.6 A_{rms} max. 34 V_p ±20% (f/w rect. AC), 0.6 A_{rms} max.
absolute max	30 VDC 84 V_{p-p} (AC) 42 V_p (f/w rect. AC)

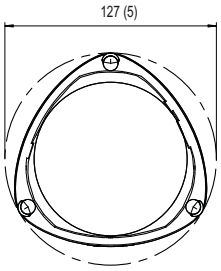
Electromagnetical compatibility

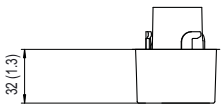
Complies with EMC standard: EN61326-1:1997 + Am1:1998 + Am2:2001; Generic Environment.

Dimensions

Dimensions in mm (inches).







Mounting kit (optional)

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Vaisala Oyj, P.O. Box 26, FIN-00421 Helsinki, FINLAND
Tel: +358 9 894 91, Fax: +358 9 8949 2485
Email: industrialsales@vaisala.com

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Ref. B210417en 2004-10

Snow depth

Snow-depth sensor – USH-8

The robust design of the USH-8 makes it ideal for the reliable measurement of snow-depth in extreme conditions. It is used by the central weather services all over Europe as well as by the avalanche warning services in high mountain regions. The ultrasonic membrane incorporated into the USH-8 stands out due to its long service life.

The additional air-temperature detection feature permits precise measurement of snow-depth over a wide temperature range.

The powerful ultrasonic impulses emitted by this snow-depth sensor deliver reliable readings even when there is a difficult reflection ratio, as is the case with powdery or fresh snow.

The sensor is characterized by its high level of operating reliability, low energy consumption and ease of use in the field.

The operating parameters and adjustment settings of the USH-8 are controlled simply and easily via a standard terminal program installed on a PC or laptop computer.

Features and characteristics

- Hard-wearing, highly robust measuring head
- Precise measurement thanks to integrated temperature compensation
- Reliable readings even with the difficult reflection ratio caused by powdery or fresh snow
- Analog and digital interface ensures universal application
- Intelligent processing of measurement readings for compensation and filtering of effects of the weather
- Watertight design for outdoor use in the open air

Hydrology · Meteorology · Geology

Technical specifications

USH-8

Measurement range – Snow depth	Measurement range: 0 to 8 m; resolution: 1 mm; accuracy: 0.1 % (FS) Measurement principle / sensor: ultrasonic (frequency 50 kHz; beamwidth 12°)
Measurement range – Temperature	Measurement range: -40 °C to +60 °C; resolution: 0.1 °C; non-linearity: ≤0.15 % Measurement principle / sensor: semiconductor (external sensor in air-cooled radiation shield)
Functions	Distance or depth measurement (configurable)
Interface – Analog	Distance / snow level Signal: 0/4 to 20 mA (configurable); resolution: 12 bit; max. load 100 Ω
Interface – Digital	Distance / snow level and air temperature Interface: RS 232; data transmission rate: 1.2 to 19.2 kBd Protocol: various ASCII protocols
Power supply	Supply voltage: 10,5 to 15 VDC Current consumption: max. 200 mA (measuring phase, approx. 3 seconds); 5 mA (standby) Energy consumption: 0.5 Ah / day (with measuring interval of 1 minute)
Lightning protection	Discharge capacity: built in lightning protection with 0.6 kA discharge capacity
Range of application	Operating temperature: -40 °C to +60 °C
Housing	Basic dimensions: diameter: 80 mm; length: 230 mm Thermal shield: diameter: 110 mm; length: 120 mm Material: Anodised natural aluminium Total weight: 2 kg
Protection rating	IP 66
Installation	Mast-mounting device for 61 mm (2 “) pipe

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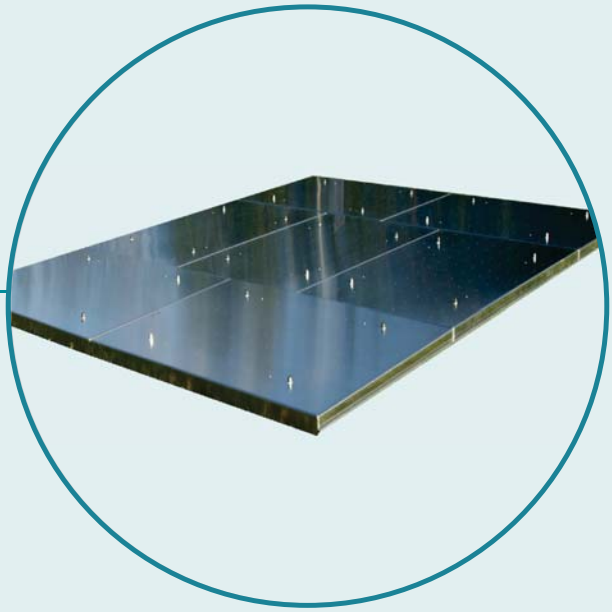
Version 002

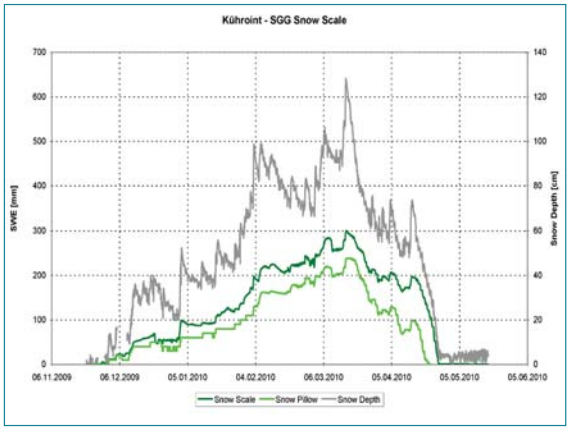
PRODUCT INFORMATION

sommer
MESS-SYSTEMTECHNIK

SGG

Snow Scale for Snow Water Equivalent (SWE) measurement





Functions and advantages

- Automatic Measurement of Snow Water Equivalent (SWE)
- Realistic represenation of actual snow
- High representativness of the measured value and minimisation of ice bridging effect
- Optimised thermal flow between sensor and ground for high accuracy during the melting process
- Reliable, light and long life aluminium construction
- Measure up to 200 / 500 / 1.500 mm of SWE
- Simple and easy installation and setup
- NO antifreeze liquid required
- Simple systems integration
- Flat construction design

Description

The SGG Snow Scale is a precision Snow Water Equivalent measuring device which is developed for quick and easy installation and implementation in the field. The SGG uses exactly for SWE measurement designed aluminium plates which garuantee accurate measuring values. A broad outer frame of plates minimises the effects of ice bridging commonly experienced late in the measurment season. The use of lightweight aluminum materials minimize thermal resistance improving heat flow throughout the device for better emulation of natural conditions. Integration and connection to weahter stations or other signal processing systems are kept easy and simple.

Functioning characteristics

The working principle of the SGG is based on the measuring principle of load cells. The sensor consists of seven 2.8 x 2.4 m and perforated plates each plate of the size of 0.8 x 1.4 m. The center panel and six surrounding panels allow water to percolate through the sensor. Water percolation minimizes thermal differences between the sensor and surrounding panels act to buffer the center panel, where SWE is measured, from stress concentrations that develop along the perimeter of the sensor. This systems allows accurate measurement even during periods of rapid snow settlement following large snow accumulations. And also when the rate of snowmelt at the sensor/ snow interface was significantly different from the snowmelt rate at the soil/ snow interface on the surrounding ground.

Installation guide

The SGG is designed for modular and easy installation and maintenance in the field. The snow scale consists of an intrumented center panel surrounded by six panels that act to buffer the center panelform edge stress condition (Figure 1). Each panel is constructed and consists of a top plate of aluminum perforated with holes to allow water flow through the sensor. The SGG is supported by angle beams to provide strength and stiffness.

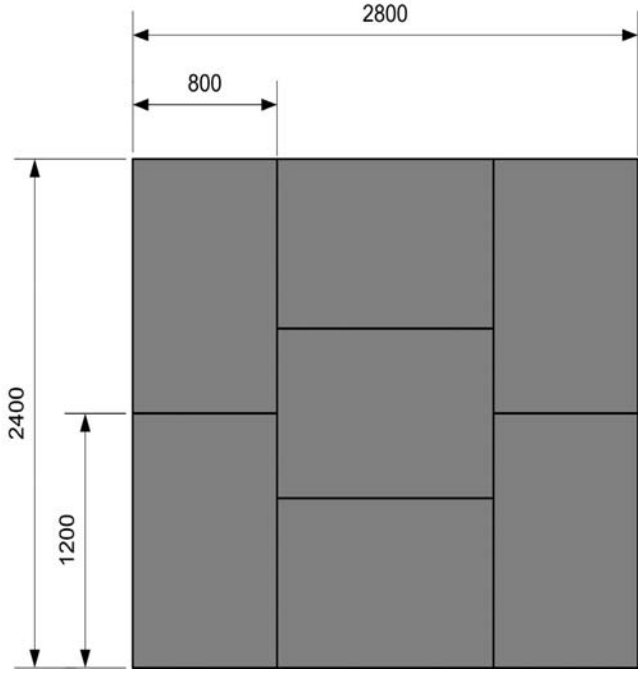


Figure 1: SGG snow scale Design

Set up

The measuring device can be set up in even inclined (up to 5°) areas. The site should be, for optimal measuring values, prepared as followed. Remove the ground and fill the trench with a thin layer of gravel or sensor so in the end the SGG is flush with the surrounding ground. The support pedestals and load cells rest on aluminium base plates, placed on this gravel pad (Figure 2)

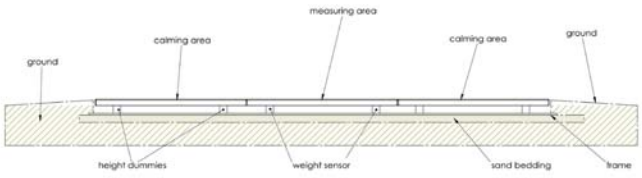


Figure 2: SGG snow scale set up

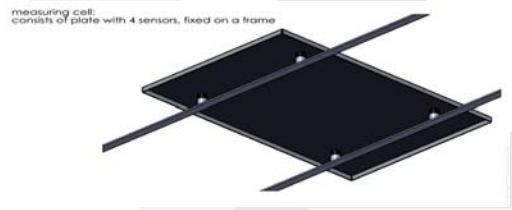


Figure 3: SGG measuring cell construction

Set up example:

In Switzerland, Davos (2.660 m) the SGG snow scale has been set up in the ground. So the SGG and the surrounding ground are on the same level. Aim is that the snow scale takes over the characteristics of the ground and therfore the measuring values should have a higher informative value.

Figure 4 Preparation measuring site Davos

Figure 5: SGG snow scale set up Davos

System applications

- Water resource management
- Flood risk management
- Monitoring of precipitation
- Automatic snow load monitoring

Technical Specifications

SGG Snow Scale - water equivalent measurement	
Range of measurement	3 ranges: 0 to 200 mm SWE, 0 to 500 mm SWE, 0 to 1500 mm SWE
Resolution	0,1 Kg/m² ≙ 0,1 mm SWE (*)
Accuracy	0,2 % (*)
Measuring surface	6,72 m²
Total weight	110 Kg
Dimension (mm)	L = 2800 B = 2400 H = 60
Packaging (mm)	7 x L = 800, B = 1200, H = 30; bars: L = 2800
Protection	IP 68
Power supply	11 - 30 VDC
Power input	max. 50 mA
Operating temperature	-40 to 80°C
Max. inclination	5°
Output	SGG 200 4 - 20 mA ≙ 0 ... 200 mm SWE SGG 500 4 - 20 mA ≙ 0 ... 500 mm SWE SGG 1500 4- 20 mA ≙ 0 ... 1500 mm SWE
Order information	SGG 200: range 0 ... 200 mm SWE SGG 500: range 0 ... 500 mm SWE SGG 1500: range 0 ... 1500 mm SWE
Others	Connecting box with high voltage protection

** All declarations of weight and accuracy refering to standardised weights*

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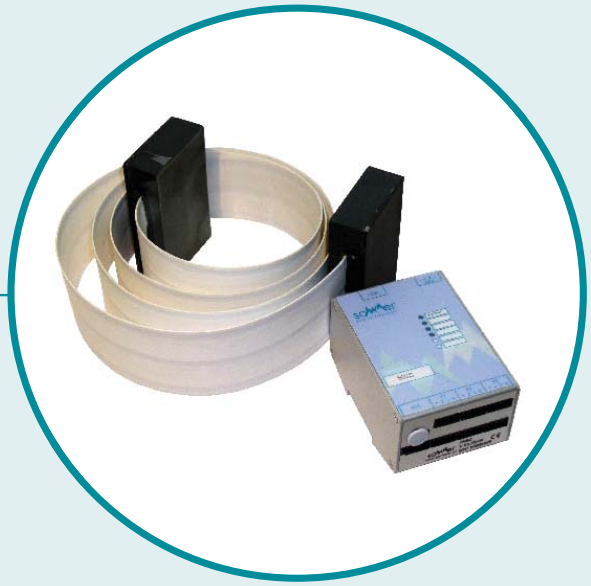
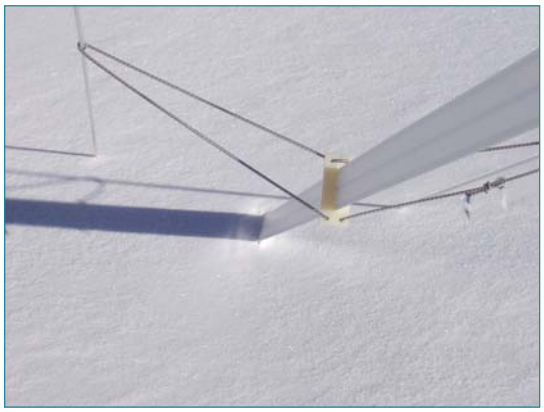
PRODUCT INFORMATION

SPA

Snow Pack Analysing System





Properties and Advantages

- **Registration of the snow parameters:**
  - Snow depth
  - Snow density
  - Snow water equivalent
  - Contents of liquid water and ice
- **System assembly on demand**
  - Information above the whole snow cover
  - Information above a specific snow depth level
  - Information above an extended area, by measuring with up to 4 SPA- sensors
- **No measurement errors caused by ice layers in the snow cover**
- **Simple and convenient installation even at hillsides**
- **Automatic, continuous measurement**
- **Energy- saving sensor operation**
  - „Standby“ between the measuring phases
  - Optimum for solar- powered stations

Area

Multiple SPA- sensors are installed in a star shape. The measurement values of the sensors are averaged and supply information with a high spatial extent as it is used for example to calibrate remote- sensing data.

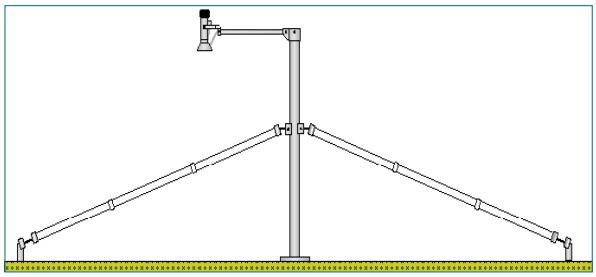


Fig. 4: Schematically figure of the system assebly Area.

Example for application

The SPA- system measured high resolution data in the winter season 2006/2007 for the parameters snow water equivalent, snow density, snow depth and liquid water content of the snow pack. The snowmelt period in april is the most interesting period. First the snow depth is decreasing (A), then the liquid water content is rising (B) and ten days after that the snow water equivalent is decreasing (C). At that point the snowmelt run- off starts. That shows, that the SPA- system can improve the prediction of snowmelt run- off.

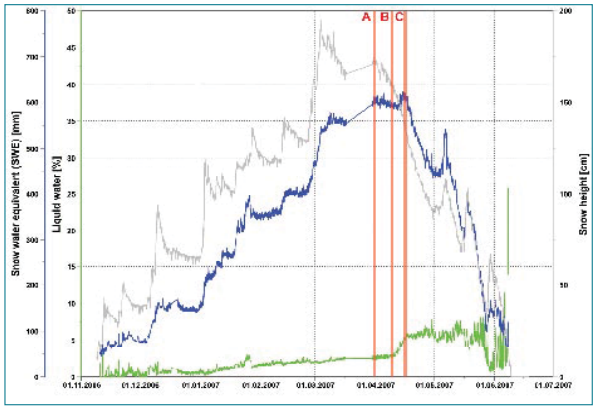


Fig. 5: Data of the SPA- System in the winter season 2006/2007.

Components of the system

Component	Description
SPA- sensor	1-4 sensors mountable
	3-10 m sensor length
	Weatherproof and UV-resistant flat band that includes three wide copper wires
	4 cm depth of penetration of the measurement field
Suspension of the SPA- sensor	Mechanic for fixing and spaning of the SPA- sensors
	Sloping sensors featured with a displacement sensor to improve the calculations of the sensor length
Measurement and control unit	Impedance analyser performing the measurements of the complex impedance along the SPA- sensor
	Multiplexer controls the switching between multiple sensors and connects the snow depth sensor
	Control unit performs the measurements and the calculations of the snow parameters; serial interface RS 232; ASCII format
Snow depth sensor	Ultrasonic snow depth sensor with integrated temperature compensation
Optional components	Integration of up to two sensors for temperature (snow, soil, surface)
	Mast & mechanics
	Power supply
	Data logging & data transfer

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Hoskin Scientific operates out of three offices within Canada:

3735 Myrtle Street,
Burnaby, BC V5C 4E7
Phone (604) 872-7894
Fax (604) 872-0281
email salesv@Hoskin.ca

4210 Morris Drive,
Burlington, ON L7L 5L6
Phone (905) 333-5510
Fax (905) 333-4976
email salesb@Hoskin.ca

300 Rue Stinson,
Montreal, PQ H4N 2E7
Phone (514) 735-5267
Fax (514) 735-3454
email salesm@Hoskin.ca